The Welding Engineer

Reg. U. S. Pat. Office

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(See Page 28)

ioneer Business and Technical Journal of the Welding Industry

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In welding, you are literally *burning money*—money represented by the deposit material consumed and the welder's time.

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THE WELDING ENGINEER

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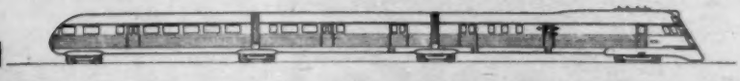
*STREAM-LINED GAS FLOW
**NO WEIGHT HANDICAP!



*Stream-lined gas flow.—Acetylene flows *straight thru the torch*—from valve to goose neck—in large passages, free from sharp offsets or restrictions.

This stream-lining eliminates turbulence, lowers operating pressures and produces sharp welding flames that weld faster, because the heat is *all* directed where it is needed—into the weld zone.

Take the handicap weight off your welders . . . chase the blues out of their hearts . . . and ease the reds off your ledgers. There's big news available about REGO GX UNIVERSAL torch achievement that spells profit for you. It's yours for the asking. Write for it now.

Distributors in All Principal Cities

**No weight handicap.—The handle is *solid, tubeless* and contains *no soldered joints* nor screws. It is made of drawn and forged Duralumin, having one third the weight of brass and greater strength than mild steel. That is why the GX is the Universal Torch, because it covers the entire limits of the process—*and carries no handicap weight.*

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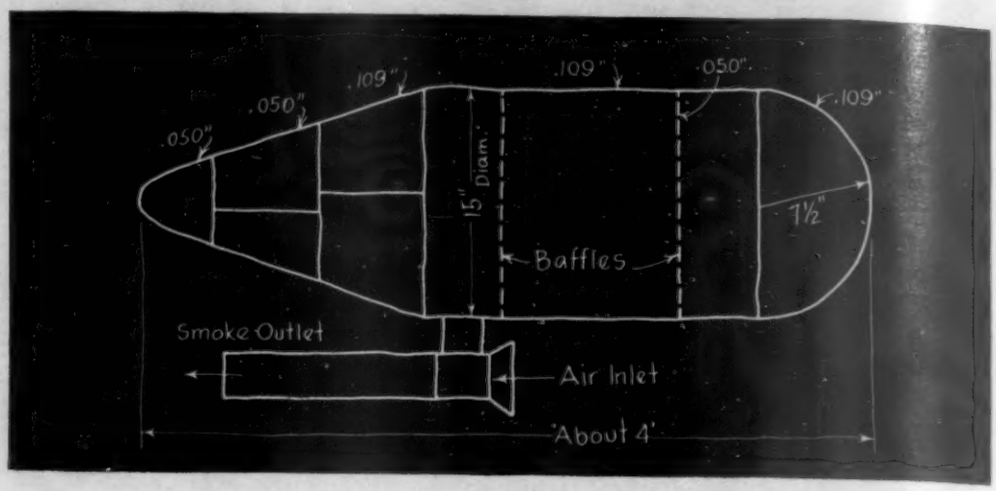
· E D I T O R I A L ·

Petroleum Welding Code Gives the Small Fabricator a Break

• Compared with the narrow specifications of the A. S. M. E. Boiler Code and Unfired Pressure Vessel Code, the API-ASME code for pressure vessels handling petroleum liquids and gases, recently released, is a most liberal document, from the point of view of the fabricator. A high degree of liberality in design and test requirements is shown, and yet there is no "letting down of the bars" to good welding. Because of the nature of the service of operation of petroleum vessels, standards had to be developed for periodic testing of such vessels—not required with boilers and unfired pressure vessels coming under the older codes. But what the fabricator should be especially concerned in, is the lack of requirements, in the new code, for x-raying or stress-relieving. ¶ At the outset, it should be understood that the API-ASME code does not supersede the older, well-known codes for boilers and pressure vessels. The new code merely extends approved welded and riveted fabrication to a field entirely outside that covered by the other codes. It does not eliminate x-raying and stress-relieving from consideration. But it does accept the non-x-rayed and non-stress-relieved vessel as the basis for its provisions relating to joint efficiencies, from which are calculated the minimum plate thicknesses. With such a vessel as the basis for consideration, the code allows the designer to calculate his plate stresses on a specified joint efficiency, determined by the type of joint and the grade of carbon steel used. If the vessel is x-rayed, this joint efficiency can be increased by 12% for design purposes; if stress-relieved, it can be increased by 6%, and if both x-rayed and stress-relieved, the factors are multiplied, giving an increase of 18.7% in joint efficiency over a vessel not radiographed or stress-relieved. Thus, within the limiting temperature of 1000° F., the fabricator can calculate his costs on the following four bases: (1) Without x-raying and stress-relieving (up to 1¼-in. plate); (2) without x-raying and with stress-relieving, allowing a slightly thinner theoretical plate thickness; (3) with x-raying and without stress-relieving (up to 1¼-in. plate), allowing a greater reduction in plate thickness, and (4) with both x-raying and stress-relieving, which allows a theoretical reduction of 16% in plate thickness compared with the vessel not x-rayed or stress-relieved. ¶ It does not follow that x-raying and stress-relieving are "out," as far as vessels coming within limitations are concerned. Those fabricators who have a large investment in stress-relieving furnaces and radiograph equipment will likely find that the 4th basis for calculating costs will be the cheapest—at least for most types and sizes of vessels—and those who have no x-ray equipment of their own but are in a position to obtain laboratory service or rent the needed devices for x-raying or gamma-raying, may find that such service or rental charges will more than pay for themselves in some instances. That is a matter that only cost calculations will determine. ¶ Also, one must recognize the fact that the fabricator equipped with x-raying and stress-relieving equipment can take advantage of the fact that the increased joint efficiencies for x-raying and stress-relieving apply to *all* vessels built under the new code, regardless of size or operating conditions. ¶ Thus, this code adds a new note of competition in the supplying of vessels coming within its provisions—a situation that no doubt will work to the advantage of the refiner and any others on the buyers' side. It is to be hoped that a fair test of the Code will work out satisfactorily in this respect. In that case, it is likely that an attempt will be made to emulate the general plan in other fields, including those covered by other codes. ¶ Even under the new code, the buyer and user of vessels are safeguarded every bit as well as under the codes relating to other fields. The code provisions cannot be construed as a "let down" from safety standards.

AN ADVERTISEMENT FOR NICKEL-BEARING WELDING RODS MANUFACTURED BY THE INTERNATIONAL NICKEL COMPANY



I *Cover the* WELDING *Front*

. . . being just a natcherel born trouble-shooter!

A FEW weeks ago I'm planning a little hunting trip, when the next I know a Pullman porter is shoving me off a train at the town where they make smoke screen tanks.

What are *they?* Somewhere in my pockets I've got a sketch I made. It's rough but you get the idea. (See Nick's sketch, above. Editor).

Each tank is made of Monel Metal full finished sheet .109 and .050 thick, welded with No. 30 Monel Metal Arc Welding Wire, 3/32" diameter.

This outfit standardizes on Monel Metal because they need a metal that is strong and rigid and at the same time able to resist the action of chemicals. The tanks carry these chemicals until the pilot is ready to lay his screen. Like everything used on a plane, these tanks have to be tough and light, which means good welding, and Monel Metal is okay for that.

So we take this tank and weld the longitudinal seam in the body by metallic arc. Next we electric weld the baffles into the shell. Then we fit on the streamline nose, leaving about a 20 gauge space, and tack and electric weld it. Last of all we gas weld the lighter gauge cone sections, using Inco Gas Welding Flux.

INCO WELDING RODS and FLUXES

***for* PURE NICKEL**

Oxy-Acetylene . . . "T" Nickel Gas Welding Wire.
Metallic Arc . . . INCO Nickel Metallic Arc Welding Wire No. 31.
Carbon Arc . . . INCO Nickel Carbon Arc Welding Wire No. 21.

***for* MONEL METAL**

Oxy-Acetylene . . . Monel Gas Welding Wire. For flux see * below.
Metallic Arc . . . INCO Monel Metal Arc Welding Wire No. 30.
Carbon Arc . . . INCO Monel Carbon Arc Welding Wire No. 20.

***for* INCONEL**

Oxy-Acetylene . . . Inconel Gas Welding Wire. For flux see ** below.
Metallic Arc . . . Inconel Metallic Arc Welding Wire No. 32.

***for* NICKEL-CLAD STEEL**
(for welding of Nickel side)

Oxy-Acetylene . . . "T" Nickel Gas Welding Wire.
Metallic Arc . . . INCO Nickel Metallic Arc Welding Wire No. 31 and No. 35†.
Carbon Arc . . . INCO Nickel Carbon Arc Welding Wire No. 21.

FLUXES

*INCO Gas Welding and Brazing Flux for Monel Metal.
** "Cromalloy" Gas Welding Flux is recommended for Inconel.
† For vertical welding.
No flux is used for the gas welding of Pure Nickel or Nickel-Clad Steel.

INCO welding materials as listed can most conveniently be obtained through regular INCO distributors.
Detailed welding instructions furnished on request.

The inspector looks her over and chirps, "She looks jake now, but wait till we give her the water cure." So he jolts her with 250 pounds hydrostatic. She holds.

The boys in the plant all give me the hand, because that inspector is a bear on having everything just right.

✡ ✡ ✡

From there I'm shot down to a big Southern rayon plant. They have some Nickel tubing (16 ga. walls, 2" and 3" diameter) that's been in ammonium sulphide service two years, and can I tell their shop why this pipe won't weld?

They're making changes in their piping layout and some welds in the new job are cracking, whereas they had no trouble at all when the old job was welded two years ago.

I take some coarse emery cloth and clean the Nickel tubing right down to the quick. When I get her all bright, I give her the gas, using "T" Nickel Gas Welding Wire with no flux. No sign of any crack.

The boys think there's a catch in it. So we weld another. And another. I show them their grief is in not starting clean. "Something in the sulphide. Your chemical sharps can tell you the why of it," I say.

Just as I'm about to leave, the foreman says to me, "Nick, can you stay over tomorrow?" "What for?" I ask. "I'm going hunting, and I'd like for you to go along." So you see my job isn't so bad after all.

And the same to you,

Nick Rodder
INCO WELDING SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

The Welding Engineer

VOLUME 19 NOVEMBER, 1934 NUMBER 11

Comments and Suggestions Looking Toward

Improving the Quality of Spot Welds

■ By A. M. MAC FARLAND
Consulting Welding Engineer

THE remark has sometimes been heard: "I don't think much of spot welding. We have a lot of failures in our spot welds. You never know if and when they are going to fall apart." At the same time the person making the remark is probably riding around in an automobile that is spot welded at many important points; and if the spot welds were as undependable as he believes, the doors would fall apart, the hinges would fall off, and a large part of the metal work would come to pieces.

As a matter of fact, spot welding is as good as the man and machine responsible for it, and its quality reflects the care and supervision that is given it.

First Requisite Is Uniformity

To obtain satisfactory spot welds, one must work for uniformity. After the original set-up is established, uniformity of work depends on maintaining the original conditions.

Many factors may operate to change the character of the weld, in which case periodic inspection and skilled supervision are necessary to maintain uniformity. The type of labor usually selected to operate spot-welding machines cannot be depended on to keep the machine in order. The condition of the equipment must be checked periodically.

The points and electrical apparatus must be maintained in their proper condition by constant supervision. If the points overheat, they will burn and stick; this will happen if the cooling water is too far from the point or does not circulate rapidly enough or if the point is too slender to transmit the heat quickly.

An up-to-date cam-operated machine may be adjusted to give a definite result and may be kept that way by a little skilled attention to the condition of the points.

A crude, cheap machine requires a skilled operator. While it is more or less satisfactory for rough work, the work is good or bad according to the skill of the operator and the attention he gives the machine.

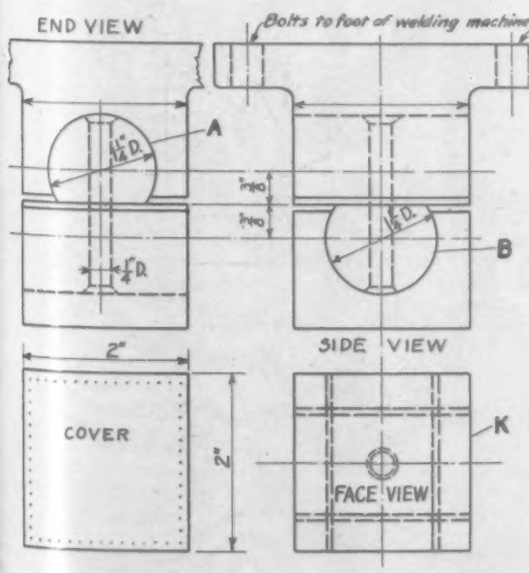


Fig. 1. Toggle-Action Pressure Foot for Spot Welding Pan Covers.

(*A* and *B* are phosphor-bronze 1¼-in. round bars, 2 in. long, flattened on one side, riveted together and set into copper blocks to allow welding foot *K* to adapt itself to variations of angle of the box tops.)

Factors Affecting Nature of Weld

The character of the spot weld is governed by:

(a) The amperage and timing of the welding current.

(b) The condition of the points.

(c) The pressure imposed during the welding operation.

(d) The condition of the surfaces to be welded.

(e) Whether the material is warped or buckled such as to affect the contact.

The old-type machine had a rough method of measuring off the amount of current used; and if the surfaces were not clean or the contact was not good or was *too good*, or the points were corroded or scaled or were too sharp or too blunt, some welds would be burned, while some of the spots would not be welded.

In ordinary spot welding, the heat is generated between the contacting surfaces by the low-voltage current passing from one surface to the other and because of the comparatively poor contact between the surfaces.

The voltage, or electrical pressure, forcing the current across the poor contact, generates heat at the point of contact. If the contact is *too good*, there is not much resistance, and not much heat is generated. If the contact is *not good*

enough, the low voltage ordinarily used will not force any current through it, or at least not enough to weld.

Welder Adjustment Depends on Surface Resistance

The condition of the plate surface has an effect upon the quality of the contact. Ordinary hot-rolled steel plate has a thin coating of mill scale, or iron oxide, which supplies enough surface resistance for spot-welding purposes. Cold-rolled steel, with a clean, bright surface, offers less resistance and requires some change in adjustment. Copper sheets are difficult to spot weld, because there is not enough resistance to generate a welding heat unless an excessive amount of current is used.

Also, the concentration of current is a factor. A machine of a certain capacity that will not weld with a ⅜-in. point may weld satisfactorily with a ⅛-in. point because the heat is concentrated on a smaller spot.

The ideal condition for a spot weld is to have a good contact between the points and the job and a rather poor contact between the surfaces to be welded, so that the current will flow readily from the points to the job and not generate much heat here, but will generate its maximum heat between the surfaces to be welded.

Plate coated with lead or tin introduces complications. Lead forms an oxide on the points, which increases the contact resistance and burns the points.

Generally speaking, spot welds are good as long as the points are kept clean. Frequent cleaning is necessary. While copper points are ordinarily used, other materials are available for special jobs. Various alloys have been developed, adapted to increase the electrical resistance or better to withstand the heat.

Automatically Compensating for Variations in Thickness

Spot welding is used extensively in the automobile industry. Door-frame assemblies, comprising 2, 3, 4, 5 and 6 ply of 18 and 20 gauge material, are being spot welded without changing the setting or adjustment of the machine; 2-ply being followed with 6-ply, and a good, solid job being made of both. This is made possible by means of an attachment on the welding machine which not only times the current but also integrates it, allowing a constant amperage to flow for a given time, regardless of variations in the resistance or ply of the work.

Such integrating current timers are desirable for welding tricky alloys or where it is necessary to change from 2-ply to 3 or 4-ply or from thin to thick material, without changing the adjustment of the machine. But the ordinary run of shop work can be handled with good, up-to-date standard equipment, provided it is kept in order and has a moderately accurate timing device.

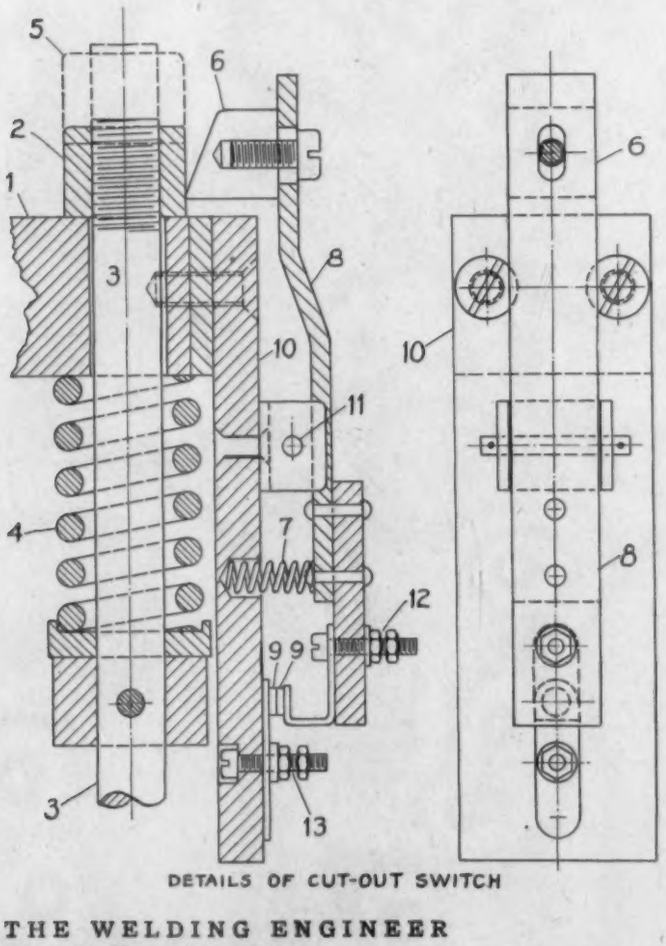
The problems encountered in spot or projection welding sometimes require rather ingenious solutions.

There is the case of a production job requiring the welding of 22-gauge steel dust covers on 300,000 pressed-steel boxes, about 2 in. square, having ⅛-in. wall thickness. The covers were copper plated, and pin-prick projections about ⅛ in. apart were stamped around all four edges in line with the center of the box walls. It was necessary to find some means of allowing the welding foot to adapt itself to variations in the plane of the box tops, so equal pressure would be applied on all sides of the box during welding.

Welds 60 2-In.-Square Covers per Minute

As a solution to the problem, a welding foot of such size as to fit the cover, was mounted on a toggle joint, as shown in Fig. 1. A cam-operated spot-welding machine with a 100-kva. transformer was fitted with a special fixture to hold and feed the boxes. The covers were satisfactorily welded at a rate of about 60 per minute.

The copper plating on the covers seemed to improve the welding job. Some of the covers were chromium plated; these welded all right, but the



DETAILS OF CUT-OUT SWITCH

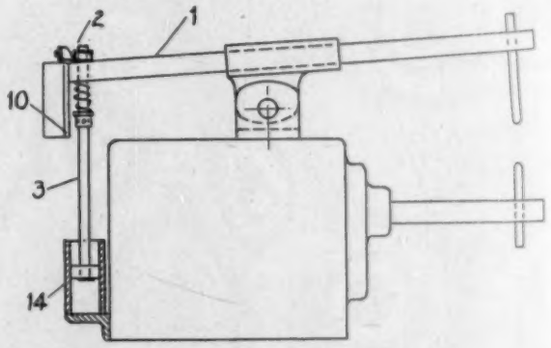


Fig. 2. Cut-Out Switch for Attachment to Air-Operated Spot Welder.

(When air is let into cylinder *14*, it forces the piston upward and moves rod *3*, which lifts the rear end of the upper welding arm *1* by pushing upward on spring *4*. When the welding point strikes the piece to be welded, arm *1* cannot travel any further; then as pressure builds up in the air cylinder, the lift of rod *3* compresses spring *4* and lifts nut *2* above the arm as shown by dotted outline *5*. This allows cam *6* to move to the left, actuated by spring *7*, and opens contacts *9 9*, thereby breaking the circuit to the hold-in coil of the main contactor and cutting off the welding current. A piece of red fiber or micarta *10* carries steel lever *8*, pivoted at *11*, and also electrical contact points *9 9*. A loop from one side of the line to the main-contactor hold-in coil is connected to terminals *12* and *13*, so the contactor opens when contacts *9 9* are separated by movement of arm *8*. Baseboard *10*, carrying the switch mechanism, is bolted to the rear end of arm *1* in such a way that nut *2* will operate cam *6* when it lifts and will close contacts *9 9* tight when it moves to its down position.)

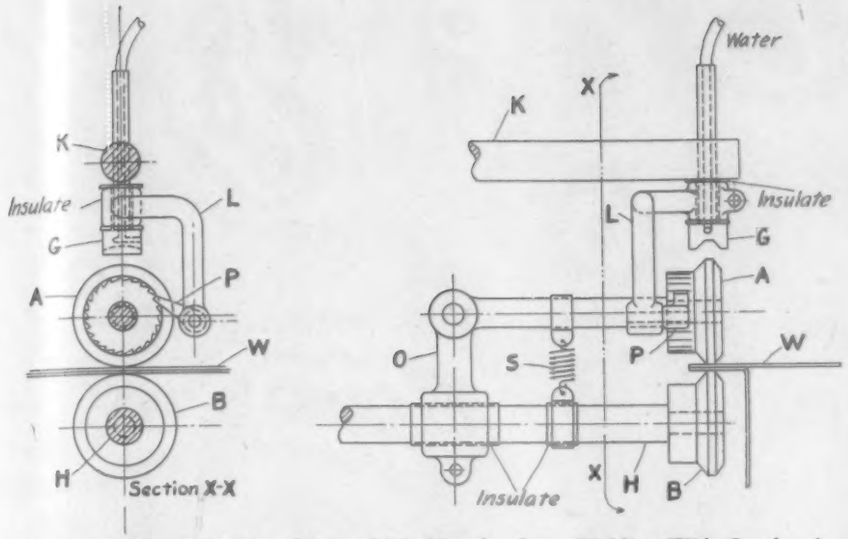


Fig. 3. Attachment for Cam-Operated Machine for Seam Welding With Overlapping or Spaced Spots.

(*K* and *H* are the upper and lower arms, respectively, of the spot-welding machine. *A* and *B* are welding rollers, made of copper. *B* is carried directly on the end of the lower welding arm. *A* is mounted on a short copper jack-shaft, pivoted on arm *O*, which is attached to arm *H* as shown. Spring *S* holds the two welding rollers together. Arm *K* is raised and lowered 150 times a minute by its cam. When it comes down, block *G* makes contact with roller *A* and applies pressure, thereby allowing welding current to pass through rollers *A* and *B* and resulting in a spot weld. When arm *K* lifts, after the current has been cut off by the cam action, it turns roller *A* by one notch or two notches, or more, by means of pawl and ratchet *P*. The pawl carries a guard, which may be adjusted for one or more notches, as desired.)

chrome was inclined to accumulate on the pressure foot, which required frequent cleaning.

In another case, a shop was using a 12-kva. spot-welding machine, operated by a pedal-controlled air cylinder, to spot weld heavy sheets. With the machine wide open, the average timing for the welds was 10 seconds. A wide variation was apparent in the quality of the welds, about 5% being so bad as to require rewelding.

The machine was controlled by a foot valve, which admitted air to the cylinder and also operated an electric contactor, turning on the welding current. Both air and current stayed on as long as the operator held his foot on the valve.

If 95% of the welds were good enough to pass inspection, it ought to be possible to make them all good, it was reasoned. Therefore, a study of the operation was made, which disclosed that the trouble was largely due to variables in the time that the operator held his foot on the valve; as he became tired or inattentive, the time might vary 100% or more from the 10 seconds desired.

Device Holds Timing to 10 Seconds

Therefore, a simple device was constructed to hold the welding current to approximately 10 seconds, independently of the operation of the foot valve. This scheme, which is shown in Fig. 2, can be applied to any pedal-operated machine at a small cost. It has a current-interrupting device, operated by the lift of the air cylinder. As the piston moves upward, it opens a pair of contacts at a certain point in its travel, which cuts out the hold-in coil of the main contactor, thereby opening the contactor and cutting off the welding current. The interval between the opening of the valve and the opening of the contacts is adjusted by means of another valve which increases or decreases the flow of air through the air pipe into the cylinder. If this second valve is wide open, a timing of about 1/10th of a second is secured. If the valve is barely cracked, the cylinder fills slowly and the timing can be extended over a much longer period. A reducing valve can be used to give a constant air pressure at the valve so the timing will not be affected by pressure variations.

An attachment for an ordinary cam-operated spot-welding machine, for seam welding, with spots overlapping or at spaced intervals, is shown in Fig. 3. This attachment may be used on overlapping seams on flat work, or for spot welding flanged heads set into tank ends.

Cam-Operated Arm Turns Welding Roller to Space Welds

For its operation it depends on an arm which is raised and lowered by cam action at the rate of about 150 strokes per minute. The movement of the arm actuates a pawl, which engages a ratchet on the upper roller and causes the roller to revolve between one spot and the time of making the next. The pawl carries a guard, which is adjustable for varying the spacing between welds. With a spacing of ⅜ in. and a speed of 150 r.p.m. for the actuating cam, about 5 ft. of seam per minute can be welded.

The seam will not be completely gas- and water-tight unless the spacing is close, but the weld is strong and is satisfactory for many purposes.

Dr. Jacobus Addresses Philadelphia Section

D. S. Jacobus, president of the American Welding Society, was the scheduled speaker for the meeting of the Philadelphia Section of the Society, held at the Engineers Club, 1317 Spruce St., on the evening of Nov. 19th. Mr. Jacobus' topic was "Historical Development of Fusion-Welded Steam-Boiler Drums and Pressure Vessels."

At Age of 73, Learns to Weld and Sets Up Shop

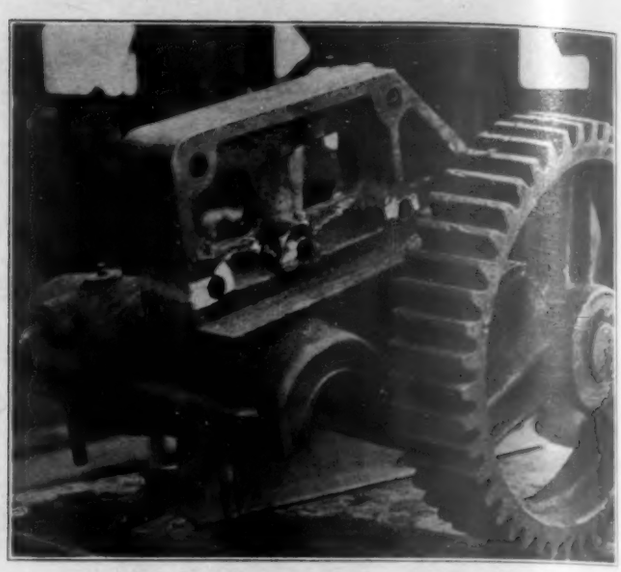
Born in 1861, and having been maintenance superintendent of a glass works for 49 years, C. P. Newman, of Kokomo, Ind., recently completed a 50-hour combination course in oxyacetylene and electric welding at a school conducted by the T. & T. Welding Works, 663 W. Randolph St., Chicago. He now is opening a shop in Kokomo for welding, blacksmithing and tool-making. While in Chicago taking the welding course, he purchased a large forge, blacksmith vise, portable drill, large anvil and stationary grinder for his new shop.

Simple Shop Stand for Cylindrical Work

In making up shop stands for supporting cylindrical work at a machine, or in welding or grinding, there is no simpler method than to use a section of old tubing, splitting the lower end three ways and spreading to form legs. These are cross braced by welding on small bars. A smaller section of tubing, with

Stand Made of Pipe Split to Form Legs.

holes for adjustment with a metal pin, may be used in the top, if desired. In either case, a pair of rollers (old wheels of most any kind) are mounted in two bars welded together at each end, and this assembly is then installed by welding into a gap cut in the top end of the stand. This provides for rotation of the work; or if work is only to be moved endwise, a straight or grooved single roller is installed.



Arc Welded Repair in Cast Iron Made With Copper Electrode

Welding with Electrodes having a Contrasting Analysis to that of the Parent Metal

■ By MILES C. SMITH
Rich Manufacturing Co., Ltd.

OF LATE, we have been engaged in a series of experiments in the field of electric-arc welding which, aside from determining a production procedure, clearly demonstrated that the use of welding electrodes having a contrasting analysis to that of the parent metal, is practical, and, at times, advisable. The production procedure had to do with the joining of relatively thin sheets of galvanized steel, but the investigation was extended until it encompassed practically the entire field of weldable metal and was particularly centered upon those ferrous and nonferrous alloys which are less frequently used and seldom welded.

For the galvanized sheet, we had particularly good success with an electrode having a metallic core of commercially pure copper, with a mantle or flux-covering consisting of a complex plated-on coating of metallic and nonmetallic content that aids in the interalloying of the weld with the base metal as well as generates a gaseous atmosphere about the weld and deposits a protective slag covering over the deposit after it is formed.

Welds Galvanized Sheet Without Disturbing Zinc Coating

When applied with the necessarily low amperage, this electrode can be depended upon to electrically weld the material without any apparent disturbing of the galvanizing adjacent to the weld. Further than that, since the chief constituent of this particular electrode is copper, the weld formed had even more resistance against the action of atmospheric and other corrosive agents than the galvanizing.

But it was not the resistance against corrosion which stimulated further experiment that led to the uncovering of many interesting facts. Close examination of the welds made on the thin sheets disclosed such an unusually interesting array of interalloyed deposits that further study seemed imperative.

Copper Is Excellent Alloying Element

Copper, as everyone knows, is a natural alloy for iron and steel. Copper-bearing steels are manufactured and sold as merchant metals and give good account of themselves. So it is not surprising to find that copper lends itself to use as weld metal for steel. After all, electric-arc welding is little more than a melting, interalloying and casting process, and any two metals that will interalloy in the steel plant or foundry should interalloy under the heat of the electric welding arc, provided, of course, nothing interferes with the normal action of the metals.

Enthused over the success with steel sheet, the same electrode was applied to steel of thicker section, then to cast iron. In each instance, the results were excellent. The interalloying with each of the parent metals was complete, and, in the case of the cast iron, the low fusing point of the electrode made it possible to weld without preheating.

Other pure copper electrodes were tried, some having no flux mantle and others provided with a flux mantle of the usual type, but with little success. Likewise, brass and bronze rods, both with and without protective mantles, were fused down with both steel and iron. And, while there was evidence of interalloying, the deposits were spongy and the physical characteristics of the welds formed were very poor.

Only Proper Heats Will Give Good Results

Naturally, great care was taken throughout these experiments so that the electrodes would be fused down at exactly the proper heat. The writer believes that too much stress cannot be put upon the importance of proper heats or amperages. So many welders either lack the knowledge or refuse to take sufficient pains to apply their electrodes at the proper temperature for the type of welding at hand. As a matter of fact, there are welders who seldom investigate to ascertain the correct polarity at which to run their electrodes when direct current is used. The manufacturer can specify the polarity to use for his electrodes, but the amperage is pretty much up to the welder's own judgment. Aside from recommending a range for each electrode, there is little he may say or do, for direct-current welding machines vary in their outputs, welders vary in their techniques, and parent metals—even the same parent metal under different conditions—require different heats to weld them. The proper heat or amperage can only be ascertained by the welder himself as he is welding. If a welder doesn't know how to determine the amperage to use for the best results, it behooves him to do some practicing before he can hope to have any degree of success in the sort of welding covered by this discussion.

Getting back to the electrodes: our success stimulated further investigation with a view to ascertaining exactly how

each of several types of electrodes would perform on the same or similar parent metal, and, since the electric welding of cast iron has most often proved troublesome, it was adopted as the parent metal to use.

Monel Metal Makes Successful Welds in Cast Iron

There seems to be no apparent reason for detailing each and every operation, but this second series of experiments did uncover at least one bit of interesting and useful information. A monel-metal electrode was found to be especially adaptable for use with cast iron, particularly castings having relatively thin sections. Monel users may or may not be surprised to learn of such a use for this nonferrous alloy, but all will agree that monel has a quite low coefficient of expansion and contraction under temperature variation, and cast-iron welders know that such a property is desirable in an electrode for that metal.

Our next series of welds were made with alloy steels as the parent metal, and this group, like the preceding one, uncovered at least one bit of useful information. Two pieces of ½-in. high-speed steel were electrically welded, using an electrode which contained recognizable percentages of both chromium and vanadium, but no tungsten, and the weld was in every way satisfactory. The only precaution taken was to space the opening between the pieces to be welded and set the heat so that the molten weld metal penetrated only half way through. The assembly was then turned over and similarly welded from the reverse side, completing the 100% penetration and interalloying.

Following this, we welded steels of various carbon but no alloy, content, with chrome-nickel electrodes, manganese-steel electrodes, chrome-molybdenum electrodes and various and sundry others. Each electrode was of the shielded-arc type and all were applied with exactly the proper heat to insure adequate penetration, maximum alloying, and solidity of deposit. In each instance, the electrode was applied with reversed polarity; that is, the electrode was used as the positive pole of the direct-current arc.

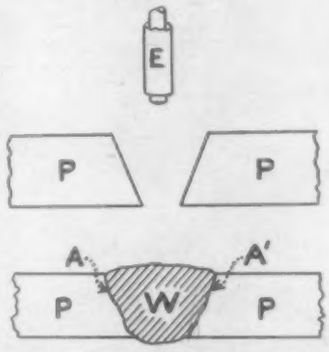
Chemical Tests of Welds Show Interalloying Action

As soon as the wide variety of welds were completed, each weld was physically tested, then analyzed for its chemical composition. That all of the welds were outstandingly successful from a physical point of view, when their appearance indicated that there had been a weld, was interesting enough, but it was the analysis of each deposit which really told the story. From these examinations, we concluded that desirable properties in a weld are only a matter of electrode selection. Electrodes which are unlike the parent metal are fully as usable as electrodes which have a like composition to that of the parent metal. As long as the electrode metal will interalloy with the parent metal to form a solid body, welding success is assured.

Such knowledge, of course, is only as valuable as it is applicable to every-day use, so the next step was to arrive at some sort of system for electrode determination that could serve as a general guidance, and our conclusions may be easily understood by referring to the accompanying chart, in which *P* designates the parent metal, *E* the electrode, and *W* the weld.

Fusion Zone Has No Definite Boundaries

If the weld be properly made and the interalloying is complete, the seemingly solid lines *A* and *A'* will, in reality, be an area of no definite boundaries, in



The Weld Metal (W) Is An Amalgamation of the Parent Metal (P) and the Electrode Metal (E).

which the parent metal and the weld metal have thoroughly interalloyed.

Should the parent metal *P* and the electrode metal *E* have identically the same chemical composition, the weld *W* formed of the two should have the same analysis, provided no constituents of either escapes during the welding operation. But should *P* and *E* not have the same composition, *W* should be an interalloyed mass, which contains the constituents of the two, less any elements that may have been driven off or destroyed during the operation.

In the case of the welding of steel with the copper electrode previously mentioned, *P* would be low-carbon steel, *E* copper, and *W* an amalgamation of the two, if the theory held good. It turned out to be just so. The areas *A* and *A'* were a composite interalloyed mass of copper-bearing steel, and easily distinguishable traces or stringers of steel were found throughout the deposit *W*. The same was found true of the other welds made. In the case of the tool-steel or high-speed-steel weld, a recognizable percentage of tungsten was located in the very center of the weld body, and the areas *A* and *A'* were alloys of chromium, vanadium, tungsten, iron, etc.

Any Interalloying Metal Is Satisfactory as an Electrode

The same was generally true of every weld examined. So much so, in fact, that we feel quite confident in making the assertion that any electrode containing metallic elements that will interalloy with the parent metal to be welded, can serve as a welding electrode for that parent metal. Further than that, it is oftentimes desirable to use an electrode with an analysis unlike that of the parent metal. As a matter of fact, when it is essential that the weld have properties not common with the parent metal, the selection of such an electrode is imperative.

Exactly how the use of electrodes having an analysis unlike that of the parent metal, will increase the scope and success of electric welding can readily be understood when cast iron is considered as a weldable parent metal. The knowledge that copper, monel and other electrodes will successfully interalloy with cast iron to form a weld makes it possible to weld this metal with the electric arc in many instances in which such welding would be out of the question with a cast-iron electrode.

What has been said about cast iron is also true of any troublesome or delicate parent metal. The use of electrodes with contrasting analysis but desirable properties makes it possible and practicable to do what has been impossible or impracticable in the past. All that is necessary is for the welder to select an electrode that will interalloy with the parent metal to give the desired properties to the weld. Whether it be for ease of operation or weld characteristics, the selection of electrodes with contrasting or unlike analyses can further welding in general and increase the adoption of welding insofar as special metals are concerned.

One Set of Curves Covers 136 Pipe Fittings

Of particular value to pipe welders and fabricators is a set of curves that have been prepared, from which it is possible to make templates for 136 different fittings. These curves are nested for economy and are given on one sheet. From them the following fittings may be made: 45° ell, 90° ell, 3-piece ell, round end, return bends, and tees. The sizes run from 1 in. to 12 in. inside diameter. The welder's pattern is simply marked off of the blueprint by a tracing wheel. Further information about this set of condensed patterns may be obtained from F. W. Bollman, 331 W. Lutz Ave., West Lafayette, Ind., who developed this set of curves.

A Glimpse at Welding in the Mexican Republic

An Interview by L. C. MONROE, of "The Welding Engineer," with H. K. SMITH, of La Consolidada S. A., Mexico City

H. K. Smith, who is engaged in "improving the quality and quantity of welding in Mexico."

WHO are the biggest individual users of welding in Mexico? What is the attitude of Mexican firms toward welding?

How much are welders' wages in Mexico and can an American work there?

These and other questions were asked H. K. Smith of The Consolidated Rolling Mills & Foundry Co., known in Mexico as La Consolidada S. A. This concern is located in Mexico City and are manufacturers of welding electrodes and dealers in welding equipment. The interview took place in Cleveland, Ohio, where Mr. Smith was recently enrolled in the course in advanced welding engineering in the John Huntington Polytechnic Institute.

The answers were such as to convince this interviewer that here is one case where the grass doesn't look greener on the other side of the fence.

By Using Airplane and Mule, One Can Go Anywhere

Before answering the above questions, Mr. Smith made it clear that selling welding in Mexico is quite a different thing from selling welding in the United States. This is largely due to the fact that many of the places where welding is being done, or should be done, are almost inaccessible. Airplane travel is a great help in reaching isolated mines, and a trip usually can be made in one and one-half hours by plane; whereas ten to fifteen days on muleback would be required to cover the same distance.

On the western coast of Mexico, however, there are some mines that cannot be reached by plane, and the only alternative is to travel by mule.

The largest individual user of welding in the Mexican Republic is the National Railways of Mexico. The National Railways have considerable oxyacetylene equipment, about 35 motor-generator arc-welding units and two gasoline driven arc-welding units for building up rail ends.

All Mines, From Smallest to Largest, Use Welding

If we tabulate the amount of welding done by the various industries in Mexico, we find that the largest users of welding are the mining industries. In many of the isolated mines a welding set is an absolute necessity even though the mine's actual requirements may be small. Many of the mines fabricate their mine cars, classifiers, build up high-carbon mine-car wheels and manganese rock crushers, etc. A mine of 20,000 tons or more daily capacity usually has three to nine arc-welding sets, and in many of these cases these sets are kept working continuously throughout the twenty-four hours in each day. Small mines have one or two machines.

The refining companies, including Standard, Shell and Sinclair, are also large users of welding. Since most of the refineries are in Tampico, an accessible seaport, problems connected with the selling of welding are not very difficult.

The Standard Oil Company of New Jersey some time ago overhauled 200 miles of 10-in. pipe line. This consisted of uncovering and lifting the old pipe which had been buried for 15 years, gas-cutting off of collars, and rewelding with shielded-arc rod. For this job seven machines with two shifts were used, says Mr. Smith. The joints were made in three passes with no backing-up strip. For the first pass 3/16-in. rod was used to insure penetration; ¼-in. rod was used for the second pass, and 5/16-in. rod for the final pass. All the welders were trained by Mr. Smith and they averaged 22 welds per 8-hour day on this job. This method of overhauling has proved so successful that other oil companies are doing the same with their old lines, one such project involving the reconditioning of 125 miles of pipe of various sizes.

Practically all new pipeline construction is welded. Just at this time, several long and short distance oil lines are under construction.

Mexican Welders Have Union of Their Own

The Mexican welders are rapidly getting on to the art and some of the old time welders are as good as can be found anywhere. There is a welders' union in Mexico known as Liga de Soldadores y Aijudantes (League of Welders and

Practically All New Pipeline Construction Is Welded. These Are Views of the First Mexican Oil Line to Be Welded.

Helpers). In Tampico and other places where this union operates, the welder's wage is $2.95 (American money) per 8-hour day. At the mines, which lie outside the territory of the union, the wage is 42c per day. All welding is done by Mexicans. At present Americans cannot emigrate into Mexico without first investing $2800 in some Mexican business, and hence, practically all Americans who enter Mexico go across as tourists without the intention of residing in the Southern Republic.

With few exceptions, all the welding machines in the Republic of Mexico are of American manufacture, and many of the manufacturers have agents or district offices in Mexico City.

The welding salesman's life is not a bed of roses as is evident from Mr. Smith's description of some of his travels and his daily schedule.

A Typical Day's Schedule for the Salesman

In the large centers he will call on two or three customers or prospects per day. The first call is about 9:30 and his work continues to 1:00 p.m. People in that country do not work from 1:00 to 3:00, but in accordance with custom he will have a big lunch, and if he happens to be in Mexico City or Monterey he will play nine holes of golf. He then goes back to work about 3 o'clock and stops some time between 6:30 and 8:30 p.m.

Regarding his trips across country and into remote places, Mr. Smith had some interesting details to relate. About 95% of his traveling is by privately hired airplanes and in some cases, where roads are passable, by hired automobiles. Train travel is tedious. Generally one passenger car is hooked on to the freight at the rear. The first five seats are first-class and the remaining fifteen seats second-class. There are no diners.

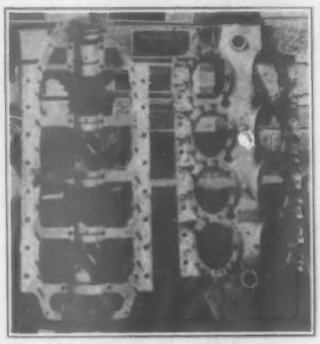
Naturally, airplane travel generally is the most desirable and is quickest. However, in the case of some mines, resort must be made to muleback. Even by using planes to the nearest point, a 10-day trip by mule is still ahead after debarking from the plane, as in some cases the plane cannot land at any point close to the mine.

This Call Requires Five Weeks, With Four Weeks on Muleback

There is one call which Mr. Smith makes about once a year which requires about two weeks on muleback in each direction. A plane is taken to the nearest point and there a guide and two mules are hired for 58c (American money) per day. The guide will have frying pans, blankets and other necessary utensils and equipment, these being known as *serape*. Mr. Smith carries his welding helmet, sample of rods, and a suitcase, all of which are packed on the backs of the mules. He also carries his own drinking water, though the guide drinks the water found along the way. Most of the way is covered on foot, with the mules being led, but occasionally, Mr. Smith says, he will ride muleback. Most of the food eaten along the way is bought from the peons, though some rations are carried along. Each day before dusk they will find a flat spot in a valley, halt for the night, and roll up in their blankets.

After arriving at his destination, Mr. Smith will spend about one week on the call, and then comes the two weeks' trek back. During the week spent at such a mine one of the most important jobs which Mr. Smith does is to assist in building up rock crusher mantels.

In the larger cities, says Mr. Smith, the hotel accommodations are first-class. Some of the smaller places have hotels, though many are without any hotel accommodations whatever. Even where hotels are to be found there are very few traveling guests. In the smaller towns



Arc-Welded Repair of Aluminum Frame of Diesel Engine, Typical of Use to Which Mexican Industries Put Welding.

the hotel guests have to put up with untidy rooms and with that animalcule known as the bedbug. Where there is no hotel, camping out is next best. Traveling is necessarily more costly than in the United States owing to the amount that must be spent on airplane hire. Gasoline is also more expensive.

Industry Holds Favorable Attitude Toward Welding

To this interviewer's question as to what was the attitude in Mexico regarding welding, Mr. Smith replied that there is no prejudice in that country toward welding, one of the reasons being that one of the largest industries in that country is the mining of silver, gold and copper, and welding is an absolute necessity in such mines. This is made apparent by the fact that 95% of the machinery used in the mines is purchased from the United States, and these mines must be kept going 24 hours per day at any cost; hence, wear and breakage of machinery are great. The cost of replacement is high but is secondary to the expense incurred by the delay in waiting for replacement parts. Replacement parts must be brought from the States, so it is but natural that the Mexican mines should resort to welding in order to keep going without excessive costs. All the mines have their own machine shops and these are equipped for finishing all welded work. Manganese welding is a very important item.

Remembering Villa's exploit in the United States two decades ago, the writer couldn't help but ask "Isn't it rather dangerous wandering around that country?" Mr. Smith replied, "I am safer in Mexico than on the streets of your American cities," and he also paid a high compliment to the climate of the Republic south of the Rio Grande.

Springfield, Ill., to Have Welders' Reunion and Clinic

A "welders' reunion and clinic" will be held by the Central Auto Equipment Co. in their building at Springfield, Ill., on Nov. 24th. This is an annual event, being an outgrowth of the company's welding-school activities. Approximately 400 welders have been graduated from the Central Auto-Smith Welding School, and this annual reunion affords a means for bringing these graduates together, as well as others interested in welding.

The program for the day begins at 10 a.m., and will include demonstrations by representatives from the Smith Welding Equipment Corp., Stoody Co., American Brass Co., Central Steel & Wire Co., and Electrox Co. There will also be a showing of "The Prosperity Process" film, an industrial drama in four acts, released by the International Acetylene Association for educational and entertainment purposes. Lectures will be given on late developments in welding, by various experts. Luncheon will be served at 12 o'clock noon, and adjournment will be taken at 5 p.m. It is anticipated that approximately 200 welders will attend, coming from all parts of the area within 75 miles of Springfield.

A. Turner, president and general manager of the Central Auto Equipment Co., will have general charge of the program. Lee Everson, of the Smith Welding Equipment Corp., Minneapolis, Minn., former instructor in the Central Auto-Smith Welding School, will deliver the main lecture and will have charge of the technical demonstrations.

Stainless Steel Is Topic at Los Angeles Meeting

"Welding Stainless Steel" will be the subject of a talk to be given on Nov. 20th before the Los Angeles Section of the American Welding Society by J. P. Morrisey, of the Crucible Steel Co. The speaker will also relate some of his experiences in connection with welding while in Russia two years ago.

Reconditioning Screw-Joint Pipe for Welding

In the past few years, there has been very little screw-thread-joint pipe of the larger sizes laid in the oil fields, especially for gas. Minute, almost undiscoverable leaks in the many screwed joints make in the aggregate a daily loss of gas that cannot be tolerated, especially where welded pipe joints will practically eliminate all leakage and wastage of gas. Hence, it is economical to convert old screw-jointed pipe to welding pipe by cutting off the collars and beveling for a welding vee.

The illustration shows 12-in. pipe on

Beveling 12-In. Pipe in the Field.

rack in the Monroe field, that is being beveled, sand-blasted, prime coated and loaded for laying in a welded gas line for the United Gas Corp. For cutting off the collars and beveling, an Airco pipe-beveling machine is being used.

Pipe of this size is no plaything, and the practical aspects of this process, which permit the pipe to be quickly reconditioned at small cost for welding, are most appealing to the oil-field fraternity.

Hard-Surfacing Steel Inserted Valve Seats

By M. E. ROGERS

The hard-surfacing of steel inserted valve seats is very successful. This method of repair is particularly valuable in the case of large engines, where heavy valve springs are used, since these are more disposed to pounding out their valve seats.

Cold-rolled shafting is ideal material for the insert ring. First the inside diameter is machined to the correct size, and then the outside is machined to within 1/16 in. of the finished size, which will allow plenty of material for "clean up" in case the valve ring warps. The ring is then counterbored ¼ in. by ¼ in., which affords a good place to lay the hard-surfacing beads.

Next, the ring is preheated to a light cherry red, and then the hard surfacing material is applied, a carbonizing flame being used. Care should be taken that the ring does not cool down below a dark cherry red during the hard-surfacing operation. After the ring is hard-surfaced, it should be placed back into the preheating fire to insure a uniform heat. The flame is then turned off, the work is covered up and allowed to cool slowly to avoid checking of the hard-surfacing deposit.

When these valve rings are properly hard-faced, they will last many times the life of an ordinary valve seat.

The above procedure is that used in the Nourse-Watson Machine Works, in Seminole, Okla. This concern installs these rings under a pressure fit. If the cylinder head is of steel, they are welded in; and if of cast iron, they are studded in place.

Get "*H. O. T.*" on Welding

■ By H. O. T. RIDLON

[This section is dedicated to Better Welding and Better Welding Shops. Suggestions and criticisms are invited.]

I Learn Who Won the War

In Pittsburgh for Armistice Day. Gosh, what a day! And I'll let all youse guys in on a secret. After all these years I just found out that it was the Yankee Division that won the War. But it was the O'Learys, O'Flinns, Flannigans, O'Days, O'Tools, here that told me so. OOOooooooo what a town!

• • •

Will See the I. A. A. Convention Under Full Steam

In a few days the I. A. A. convention will be here. Just hope this durn sheet doesn't go to press before it's over; 'cause when, as, and if possible, the Old Maestro would like to give some of the high lights and hot news flashes that happen during said convention. I've been to a few of these conventions before, and although they have left their marks on me, they haven't licked me, and me doubts if this one will be any exception.

• • •

They Risked Their Necks in a Welded Shell and Thought Nothing of It

Might I say publicly, congratulations to Dr. Jean Piccard and his wife—the kid sister—for their successful flight into the stratosphere (and by the by, it was the first successful American stratosphere flight—and, to think of it, I didn't have anything to do with it), and may I thank them for all of us for their faith in welding. Their Dowmetal gondola was an all-welded structure, that carried then more than ten and one-half miles above good old Terra Harda. And I'm telling you that old ball took a real bump when she landed. And it was not the first bump it had taken. But it stoood up perfectly. And when you figure the load that light shell carried, where it went and the changes in temperature it went through, welding really *can take it*. And my hat's off to the lad that did the welding job. It was a grand and glorious adventure. If folks like that (and they are just every-day plain folks) take such an adventure, with their lives depending on welding, we all should be able to sell more welding to the less adventursome of our neighbors. And again I repeat that *the more good welding there is done; the more welding there will be done!* Yes Sir, it's true, for I've seen it over and over again—the better the work a shop turned out, the more work they got to turn out. And I've seen it when they got careless about their work, and before they knew what it was all about, they were about ready to fold up.

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This Is the Season to Get the Farm Business

I wonder how many job welding shops out in the farm communities, now that business is slowing down, are building sales programs that will get them more business when spring rolls around again. I wonder how many are selling the farmer on getting that repair work done now; so that the gold old farm machinery will be all set for them when planting season comes. I wonder how many are building gates, out of pipe, and selling them at a nice profit. It can be done. Also various kinds of watering troughs, etc. This is the time to start out, and let them know you're on the job, and ready to serve them. Sure, Son, I know you've worked hard, and that things now are dull and it's hunting season. But it is up to you—rabbits or profits, which?

• • •

The thought for the month: Only when we stop teaching men what to think; and try to teach them *how* to think, will we start to go forward. (My most worthy and illustrous father always said that most people don't really think; they just think they are thinking. Study over that one for awhile. It's good, too.)

Metallic-Arc Welding of Gray Cast Iron

■ By GUST NYQUIST
American Arc Welders

FOR successful welding of cast iron by the electric arc, the welder must be familiar with certain fundamentals, namely, the effect of carbon on cast iron during the welding process, and the action of expansion and contraction.

If all other factors are properly considered, ordinarily clean cast iron can be welded with the arc very readily. If chemical changes have taken place in the casting during its use in service, certain precautions might have to be observed, even to the extent of preheating, although the writer would consider such cases extreme. Where castings have been subjected to heat or water, or a combination of the two, or other elements causing chemical changes such as corrosion or erosion of the iron constituent, welding becomes difficult, if not impossible. Such castings also become permeable to liquids due to their porosity, and these castings gasify under heat and cause pin holes in the weld unless the correct welding technique is used.

GOOD welding procedure must be closely followed to obtain machinable welds and prevent distortion or fracture due to contraction and expansion strains.

Eliminating Hard Spots by Precipitating Out the Carbon

First, let us consider the subject from the standpoint of making machinable welds. The writer uses a rod made from pure gray cast iron with the proper flux coating. When cast iron has reached the melting point its carbon content combines with the molten metal and, if cooled in that condition, the weld will be very hard and brittle. To secure machinability, most of the carbon must be precipitated as graphitic carbon, or into a so-called free state, just as it is in cast iron. To accomplish this, the weld metal, after coming out of the liquid state, must be maintained at a white heat for 30 seconds—the time required for graphitic carbon to be formed.

Machinability of the bond and of the weld is readily obtained for the reason that in building up the deposit the arc heat will maintain the desired temperature of the weld area. It is in the finishing where particular care must be exercised. The operator should move the arc slowly along the edges of the weld, adjacent to the base metal, gradually moving it back into the weld and across to the other edge, using care to maintain a white heat in the deposit for a half minute after solidifying. Do not move the arc rapidly from one part of the weld to the other, as this may result in a chilling action and produce hard spots. Avoid alternate heating. If for any reason the arc is interrupted, it is a good policy to start welding again when a shade of the white heat is still evident.

The deposit should be puddled in much the same manner as in gas welding, but the weaving movement should be gradual to prevent sudden changes in the heat. The finishing should be at a point where the mass of the cold base metal has the least effect in conducting away the heat, and the arc should be moved gradually back from that point and to the hottest part of the weld, where the operation should be completed. So much for the making of machinable welds.

Procedure for Those "Unweldable" Castings

If parts are encountered that resist successful welding, due to chemical changes, proceed as follows: First, bring such parts to a red heat with a gas flame, then place suitable carbon plates along the edges to prevent the molten metal from flowing away. Apply as much heat as possible to the liquid or molten metal, permitting the heat to soak thoroughly into the base metal. This usually makes a perfect bond.

Other castings may be found which, owing to their porosity, have become impregnated with oil, water, or other agents of such a nature as will form gas as soon as the heat is applied. It is important that the weld metal be held in a molten state sufficiently long to permit such gases to escape, in order to prevent pin holes in the weld. This applies to structures where expansion and contraction are not a consideration.

There are iron castings of such structure that expansion and contraction must be controlled by using the correct technique, without preheating.

Contrary to general opinion, there is a good deal of "spring" or elasticity in cast iron. For instance, a bar 1 in. in diameter and 2 ft. long, supported rigidly at the ends, may be deflected 5/16 in. and still spring back to its original state when the pressure is removed. Further, cast iron having a tensile strength of 15,000 to 30,000 lb. per sq. in. will withstand a crushing effect of 80,000 to 120,000 lb. per sq. in. This ability to withstand crushing effect will not be reduced materially until 1000° F. is attained. Moreover, shrinkage in cast iron is partially counteracted by an expansion caused by the precipitation of graphite. All these facts make the control of expansion and contraction more understandable.

Taking Care of Expansion and Contraction

Assume that a spoke 1x2 in. is to be welded and that the rim is not exceptionally heavy for a spoke of such size. An electrode of the proper gray iron, properly fluxed, should be used. The size of the electrode should be sufficient to permit using a high current for both scarfing and welding. This will localize the heat to the vicinity of the weld area. In scarfing, melt out the section half way through the break, leaving the unscarfed portion to prevent upsetting from the contraction of the heated area. Proceed to fill in immediately in order to utilize the heat developed in scarfing to facilitate fusion and to obtain the necessary heat in the casting to produce a machinable weld. Complete the first operation with the least possible delay, and at the same time guard against overheating the unscarfed section above a dark red color. Then proceed in a like manner on the opposite side. Such a weld should not require over five minutes to complete and does not present much of a problem if instructions are followed.

In exceptional cases, where the rim is too rigid to permit yielding, heat should be applied to it until the crack in the spoke has opened to about 1/16 in., which will offset the strain in welding. If such heat is not available, the welder may utilize the heat from the weld to offset expansion at the crucial point.

If Rim Is Heavy, Cut Spoke From Rim Before Welding

To illustrate: The spoke is assumed to be broken at the hub. It is too short in comparison with its diameter to permit its elastic limit to offset expansion, and the rim is too heavy in comparison with the spoke to offset expansion. First, tack weld the fracture at the hub and then cut the spoke at the rim. Now proceed to weld the fracture at the hub. The cut at the rim permits free expansion while the first weld is being completed and, when the weld is cooled, it will be found that the opening made by the hack saw at the rim is as wide as the thickness of the

hack-saw blade used. Wedge this opening tightly with suitable sheet steel before welding at that point.

To the layman this procedure may appear unnecessary and a waste of time. However, under the conditions outlined, it is quite practical because while welding the cut at the rim sufficient heat will penetrate into the rim to allow proper expansion at that point to relieve the strain on cooling.

The welder must acquire the correct technique by practicing on discarded parts until he has perfected the method of welding herein outlined, producing machinable welds. The field of cast-iron welding by the electric arc is so large that any time spent in mastering the subject should be considered a good investment.

Risks in Handling Material in the Welding Shop

(Extracted from an article by Arnold Robinson appearing in *The Welder* (London).)

Welders often require their work to be fixed in one particular position until a certain portion is welded and then the work has to be moved into a new position to suit the next length of welding. With heavy and bulky work this entails considerable risk. Few welders have heard of the simple rule of stability, that the resultant force should pass through the middle third.

When lifting heavy structures or vessels, it is safer to use wire ropes rather than chains because a wire rope gives a warning before it fractures, whereas a chain breaks suddenly. Also it is difficult to avoid snatches due to a chain link slipping suddenly to take up slack; this allows the entire load to fall through a short distance. The kinetic energy of the falling mass is absorbed by the chain and this produces a high stress which may be sufficient to cause fracture.

Avoid chains or ropes coming in direct contact with sharp edges of the work. A fatal accident has been reported, caused by a 9/16-in. chain coming in contact with the sharp edge of the lip of the firebox of a 30-cwt. boiler. The shear induced in the link was sufficient to fracture it, although the chain was amply strong enough to lift the boiler if it had been properly applied. Packing should always be inserted between the chain or rope and the sharp edge. The best packing is obtained by using woven rope mats, which last a considerable time and are easily applied. Pieces of wood are usually unsuitable, the wood being difficult to fix in position, and if it does not slip off the edge it may split apart and allow the chain or rope to bite the sharp edge.

Chains and ropes should be examined regularly and records kept in a book reserved for that purpose. Strands of rope will fracture and show as broken strands; when these become numerous in a given length of rope, the rope should be scrapped. Unless one slinger is responsible entirely for a given number of slings, etc., it is doubtful if it is wise to reduce the safe working load of a rope in preference to scrapping it, although this course is often adopted with chains. If slings, etc., are used by numerous welders to sling their own work, they become used to associating a certain size of chain or rope with the original safe working load; therefore in all cases the safe working load should be stamped on the hook and the ring of every chain and on the eye of the rope.

One accident which might have proved serious, occurred through a good wire rope being damaged with the electric arc without the knowledge of the welder, due to the rope being left fixed around the work ready for the next lift. The welder was welding very near to the rope and severed some of the strands. When the lift was taken the rope broke.

There is another case in which two men were welding a gas main with oxyacetylene blowpipes. They were working on a platform slung by four wire ropes, about 30 ft. from the ground. Apparently one of the men's attention was taken away from his welding, and in turning round to attend to something else he accidentally directed the flame on one of the ropes, which was rapidly burnt through; the platform fell and one of the men was fatally injured.

If oxyacetylene welders were working under these conditions for any length of time, it would be advisable to protect the ropes, though this is rather difficult. Perhaps a cheap and suitable method would be to lash a piece of wood to each pair of ropes at the ends of the platform and to cover the wood with asbestos.

Circular tanks are usually placed on rollers so that the tank can be revolved easily as the welder proceeds around the circumference. In most cases the tanks are light and symmetrical and the friction of the rollers prevents the tank from revolving of its own accord. These conditions had been so regular in one works that when a heavy pressure vessel with a large, heavy manhole neck and flange had to be welded, nobody thought of using a wedge between the tank and the rollers. The tank had been revolved until the manhole was on the horizontal center line. There was, therefore, a tendency for the vessel to revolve until the manhole descended to the vertical center line, because the center of gravity of the vessel was not immediately over the vertical center line of the supporting rollers. As the workman's head and shoulders came out of the manhole, the extra weight caused the vessel to revolve. There was very little clearance between the manhole and the floor. Although he withdrew quickly, one of his arms was still out when the manhole reached the bottom, and the arm was torn off.

The best method to secure the rollers is to use a peg which passes through a hole in the web of the roller and also through a hole in the side plate which carries the roller pin. A wedge may come loose or be accidentally knocked out of position. The peg should be fastened to the side plate by a light chain, otherwise it will soon be lost.

Vessel Welded 5 Years Ago Still in Good Condition

After five years of service, the welded gasometer shown was recently given a thorough inspection and found to be in perfect condition. It was built by The Thornton Co., Cleveland, Ohio, using

Welded Gasometer After 5 Years' Service.

"Lincoln" welding equipment, and has been used by a chemical plant for storing anesthetic gases. It is constructed of 10-gauge galvanized steel sheets, with all seams are welded.

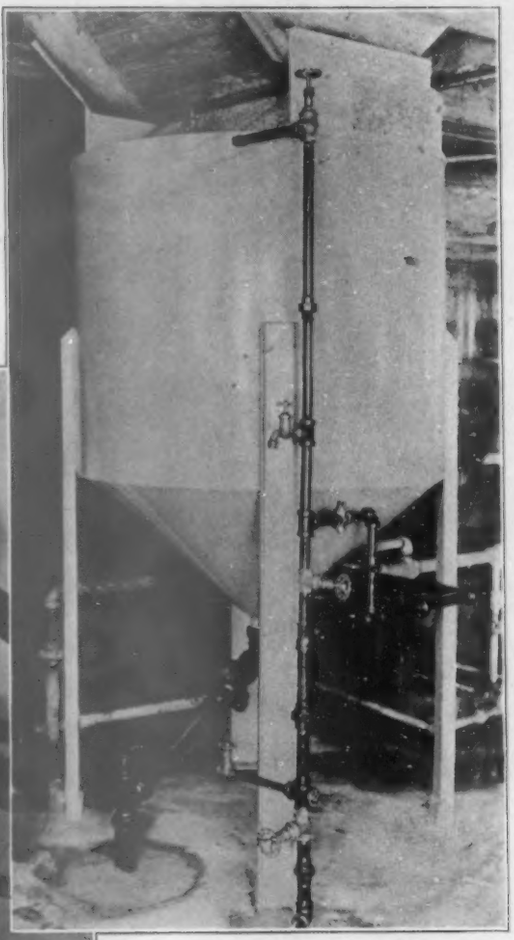
Museum Has Permanent Arc-Welding Demonstration

Complete equipment for a permanent exhibit of industrial welding has been presented to the Museum of Science and Industry in Chicago, by the Harnischfeger Corp., of Milwaukee, according to an announcement from O. T. Kreusser, director of the museum. Demonstrations will be carried on in a glass-enclosed booth to protect the public from harmful arc rays.

WELDING NEWS IN PICTURES

• All seams and joints of this steel boiler are arc welded, and staybolts and braces are welded in place. Designed for 15-lb. heating system. Light in weight and non-cracking. Made by Johnston Brothers, Inc., Ferrysburg, Mich.

• Welder plying his art, in the erection of an addition to the plant of The Lincoln Electric Co. in Cleveland, Ohio.



• For dissolving rock salt, this welded nickel-clad vessel, with monel-metal fittings and piping, is ideal, since it does not corrode or rust and does not contaminate the brine. It is 48 in. in diameter and will produce 200 gallons of pure saturated brine per hour.

• Group of all-welded oil-storage tanks at the Purol, Inc., plant on the Delaware River, at Trenton, N. J. Built by Chicago Bridge & Iron Works. A welded steel dike gives protection from river ice.

Repairing Manganese-Steel Equipment . . . .

10-in. Manganese-Steel Pump Casing Built Up By Welding, Before Peening.

Close-Up View of Welded 3½-Yd. Manganese Bucket (See Front Cover).

(After the fracture occurred, the tooth was removed, and a piece cut out, 3 in. wide and 2 ft. long. This was filled in with 5/32-in. coated nickel-manganese electrode, at a cost of $125.)

THE repair of manganese-steel equipment is being featured by McLean Welded Products Corp., 530 West 79th St., Chicago, Ill., and in this type of work this company has met with outstanding success.

In all such work, whether it be a welded repair or the building up of a manganese surface, a nickel-manganese rod is used. The parent metal itself should be kept as cool as possible, which requires that the arc not be concentrated in one place long.

Beads Are Thoroughly Peened With Air Hammer

Though on some work, a higher amperage is used than ordinarily recommended by electrode manufacturers, overheating can be obviated by skipping from one part of the work to another. In the case of pump shells, a 6- or 7-in. bead is laid, and then another bead laid on each side of the first, overlapping it somewhat. Then the three beads are peened thoroughly with an air hammer, after which three more beads are laid at some distance from the first weld, and then these are peened. Thus local heating is kept down, and the beads show no sign of cracking after cooling. Electrodes of 3/16 in. and a current of 175 amperes are used for this work.

Peening is done while the beads are still hot, and it must be very vigorous and thorough. More time often is spent in peening than in welding. Work hardening by means of peening is particularly desirable if hard-facing is to be applied later.

Hard-Surfacing Adds to Life of Parts

The building up of worn manganese-steel parts with nickel-manganese electrodes and then coating with a suitable hard-facing material extends very materially the service life of the parts. Many such parts will be kept in service even after the hard-facing has worn off in spots, since the manganese base also has

Pump Casing After Peening Welds With Air Hammer.

(The holes and badly worn spots were first filled up, using a nickel-manganese electrode, then beads were laid crosswise, as shown, taking care to prevent undue local heating. 165 lb. of 3/16-in. nickel-manganese electrode was used. After each 20 in. of bead was laid, it was worked-hardened with an air hammer. Total cost of repair was $247, while new casting would have cost $550.)

Digger Teeth Rebuilt With Manganese, Then Hard-Surfaced.

(These teeth, of manganese steel, were rebuilt at a cost of $50, including hard-surfacing 2 in. on each side. To date, they have stood up in service twice as long as new teeth.)

Views of Worn Dipper Lip After Being Built Up With Manganese and Hard-Surfaced.

(Teeth and lip were built up with nickel-manganese electrode, then peened, after which hard-facing material was applied on both sides of the teeth. The repair cost $165, about the cost of a new lip, but lasted twice as long.)

the property of resisting abrasion to a remarkable degree.

Worn Chilled-Cast-Iron Crusher, After Grinding and Cleaning.

Crusher Welded With Nickel-Manganese Electrode.

(3/16-in. electrode was used, and 135 to 150 amperes. All beads were peened. By skipping from one side of the crusher to the other during welding, excessive local heating was prevented.)

Chilled-cast-iron parts are also being successfully surfaced with manganese steel by this company. The surface to receive the weld metal must be well cleaned before welding, and after the manganese beads are applied they are well peened, as in the case of repairs to manganese-steel parts.

Saves $475 by Repairing Broken Crankshaft

Old Man Maintenance took a real licking when Oliver's Garage, at New Underwood, S. D., proved that a broken crankshaft could be successfully welded to save $475 on a repair bill.

The broken crankshaft, belonging to a 45-hp. 3-cylinder Diesel engine, weighed about 350 lb. The price of a new shaft and bearings was $550. The old shaft was welded and machined at a total cost of only $75.

In preparing the job, which was handled with a P&H-Hansen arc welder, using from 250 to 300 amperes, the shaft was blocked on a lathe to line up as nearly true as possible. The broken section was veed out with a cutting torch from one side to the center. A bead was then run through with the arc welder and the sides tackwelded sufficiently to allow the shaft to be turned over and the operation repeated on the other side. Now being strong enough to take out of the lathe, the shaft was built up a little at a time until the welded portion was larger than the original size.

The shaft was then put back into the lathe with a press mounted over it and straightened to within 0.030 in. of true as recorded by the dial gauge. Following this, all main bearings were ground 0.050 in. undersize, and then were rebabbitted and bored to fit the shaft. After being put in place, the shaft lined up perfectly and turned freely. After several months of operation, the engine is performing excellently.

Views of Broken and Repaired Crankshaft.

A Welder's Experience With Brazing

By J. B. AMES

For a number of years I brazed with the haphazard luck of many welders. In order to learn more about the process, I scanned welding magazines and attended welding meetings, and now I braze with the same confidence that good welders have in their welds.

To me, 90% of the success in brazing lies in the preparation of the work. Intricate parts must be carefully measured or jigged before cutting or chamfering, to make sure the part will fit after brazing. I always cut away enough metal along the break to know that my brazing is sound all the way through.

They say, "Cleanliness is next to godliness." That statement also holds true for successful brazing—only there is a great "fooler" wrapped up in a shiny package. In many shops where a grinding wheel is handy, an operator will bevel the edges to be brazed on the wheel. The prepared job looks perfect for brazing, but there is a "nigger in the woodpile". The black graphite has spread its thin film over the cast iron or malleable casting, and glitters with a radiance that spells doom for many brazers.

After grinding, remove the fooling film with a rough bastard file. Cut several deep cuts on an angle with the corner of the file—put teeth into the parent metal to increase the gripping surface for the bronze. On big jobs, use a sharp cold-chisel and leave the cut ragged and rough. Whenever possible, use a sand-blast to drive out the soft graphite spots and thus secure a much better bonding surface.

When the job is ready for brazing, lay it out carefully. If the work is flat and veed on one side only, allow enough sag on the ends to compensate for the pull or shrinkage in the added metal. With this in mind, your judgment will help you to overcome warpage.

Never try brazing without a good grade of brazing flux, and use one of the standard high-strength bronzes.

When your work is laid or clamped in position, select a tip several sizes larger than you would use for welding the same job. I use a neutral flame with good results. Preheat the metal back from the break, but be very careful not to reach the critical point, at which the grain structure changes. Don't exceed a cherry red, or dull red.

With the parts hot, but not too hot, play the rod through the flame, dip it in the flux, and proceed to tin the walls of the break. If the heat, flame and flux are right, the flowing bronze will spread around like a thin oil, tinning the parts much the same as solder on a soldering iron.

After the tinning process, draw the flame away far enough to eliminate any white smoke. The zinc is a vital element in the success of the job, and must not be burnt up. Proceed to fill the crater level full with the shiny flowing metal, free from pin holes, strong as the original piece, and water, steam and air tight.

Always remember, with any kind of brazing, clean the surface to be brazed perfectly, and watch the heat very carefully on cast iron, particularly malleable iron, as the free carbon on the interior will start dancing with too much heat.

A word of warning: I washed a large oil-soaked casting in gasoline, preparing it for brazing. Later a sand pocket in the metal exploded. Now I burn the oil off with a torch.

Design Charts for Welded Structural Connections

Loose-leaf design charts in blueprint form have been published by the Northern Bridge Co., 10 S. LaSalle St., Chicago, Ill. These illustrate various types of simple field tests by the hydraulic-jack method, and give test data obtained on welded brackets supporting the new roof in the train shed at the LaSalle St. railroad station in Chicago, charts for the calculation of welds for beam-to-girder connections and for the design of seat angles, charts for the design of eccentric welded connections and of beam brackets, and tables giving allowable weld stresses for design purposes and length and size of welds required to replace rivets. Other charts will be added as further data are developed. These are being sold at 50 cents for the present set, which covers cost of publishing and mailing.

Welded Base Plates for Huge Bridge Towers

The steel comprising the great towers of the San Francisco-Oakland Bay Bridge and the Golden Gate Bridge, two of the greatest suspension bridges ever built, will be erected on welded steel base plates.

Both of the 750-ft. towers being built for the Golden Gate Bridge will rest on base plates 5 in. thick. For this purpose, 19 steel slabs, 5 in. thick, the heaviest one weighing approximately 10 tons, were placed on the concrete tower base and secured by steel dowels 6½ in. in diameter set into 4 ft. of concrete. These slabs were set on red-lead paste and were electrically welded into one base plate approximately 34x54 ft. in area, forming a base for one of the tower legs to rest on.

Tower No. 2 of San Francisco-Oakland Bay Bridge Rests on Welded Base Plate.

The bridge engineers thought it best to place the welded 5-in. base plate directly on the concrete surface of the pier, instead of following the usual custom of placing grout between the surface or the concrete and the under side of the plate. Because of the large area involved, it was found necessary to leave the surface of the top of the concrete, as poured, about ⅝ in. high and subsequently grind it down to the correct level with a high degree of accuracy.

A machine was specially designed to accomplish this grinding, consisting essentially of an electrically operated carborundum wheel, 24 in. in diameter, with a 4-in. face. This wheel is operated on a carriage which rides on rails supported by a steel framework.

The San Francisco-Oakland Bay

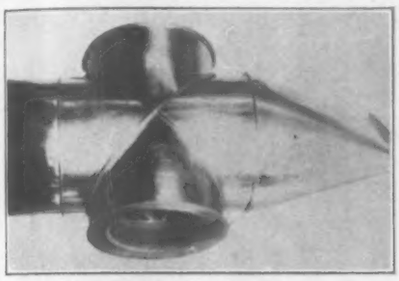
Welding 4-in. Base Plate for Supporting One of Towers of San Francisco-Oakland Bay Bridge.

Bridge includes two suspension spans with a total of four towers, two being 465 ft. in height and the other two 505 ft. in height. The base plates on which these great towers rest are formed of 4-in. rolled steel plate and are attached to the concrete piers by 3-in.-diameter bolts which protrude from the concrete. These plates likewise are welded.

Thin Tantalum Sheets Welded by the Electric Arc

Tantalum sheets worth $50 a pound and so thin that it takes 200 of them to make an inch are now being arc welded regularly in the fabrication of chemical equipment.

This metal possesses characteristics which make it especially valuable in the manufacture of all types of laboratory



Fitting Made of Welded Tantalum Sheet.

accessories. It is not tarnished by air nor attacked by acids, except hydrochloric. In tensile strength it is 2½ times stronger than platinum. It combines softness with workability and has great resistance to wet corrosion.

Tantalum is a rare metallic element found in association with niobium, and was little used commercially until recent years. Most of the supply comes from Australia, although it is found in the United States in small quantities in North Carolina, Colorado, and in the Black Hills of the Dakotas. Sweden, Norway, Greenland, Madagascar and Rhodesia are other localities where it is known to exist.

Fansteel Products, Inc., North Chicago, Ill., are one of the largest suppliers of tantalum. It is this company which developed and perfected a method for welding this rare metal, thereby increasing its field of usefulness. This method was described for the first time in *The Welding Engineer* of December, 1933, on page 18.

Exacting requirements covering the articles fabricated from tantalum have made it necessary to develop a special technique for welding it. Some of the most important factors to be considered in working with this metal are:

(1) Tantalum is a very valuable metal, costing approximately $50 per pound, or more than $3 an ounce.

(2) Inasmuch as most of the articles are custom made, the labor cost is rather high. Spoilage must therefore be reduced to the minimum.

(3) Finished welds must be strong, ductile, and both gas- and liquid-tight under pressure and vacuum.

(4) Tantalum cannot be deposited from an electrode without so embrittling the welds as to make them unusable.

(5) Tantalum cannot be heated in air much above 650° F. without becoming hard and brittle.

(6) The melting point of tantalum is above 5100° F.

In the arc welding of tantalum, a straight angle flange is formed at all edges of the sheets. These flanges are then fitted together and tack welded in a few places to avoid shifting the assembly. The job is then immersed in a tank filled with carbon tetrachloride so that the edge to be welded is approximately ¼ in. below the surface of the liquid.

Immersion in carbon tetrachloride requires higher voltage across the arc than would be needed to weld in air, and, at the same time, the thinness of the stock being welded and the necessity for strict localization of the heat, demand low welding current. Hard carbon electrodes ⅛ in. in size, held in small, light electrode holders, are used. The welding current must be of normal polarity.

Stability of the arc and ease of striking it as well as freedom from blowing are absolutely essential for producing good welds. An open-circuit voltage of 50, which falls to about 25 across the arc, usually produces satisfactory welds. The current depends on the thickness of metal, 0.005-in. stock requiring only 15 amperes and 0.025-in. 60 amperes.

Welding is accomplished by melting the edges of the flanges so that the metal runs together. This must be done quickly, since holding the arc in one spot or striking it more than once in one place is likely to result in brittle welds. Welding equipment manufactured by The Lincoln Electric Company, Cleveland, Ohio, is used in this work.

While it is apparent that special technique and considerable care are essential in arc welding tantalum, very satisfactory work is being done regularly on both large and small jobs.

Iowa and Texas to Hold Welding Conferences

The annual welding conference at Iowa State College, Ames, Iowa, will be held Jan. 23rd, 24th and 25th, according to an announcement from D. C. Faber, Director, Engineering Extension Service, who is preparing the program. A welding conference has also been projected by the Texas Technological College, at Lubbock, Texas, the date of which has not yet been set, according to word received from J. C. Hardgrave, of the Department of Mechanical Engineering.

Program of Purdue Welding Conference

The Tenth Annual Conference on Welding will be held at Purdue University, Lafayette, Ind., Dec. 13th and 14th, under the direction of the Engineering Extension Department and the Department of Practical Mechanics, with manufacturers of welding equipment cooperating. The program is as follows:

Thursday—December 13th

Forenoon

9:00 a.m. Registration, Michael Golden Shops. Exhibits and demonstrations.

10:00 a.m. "Some Suggestions for Qualifying Welders," by E. W. P. Smith, Consulting Engineer, Lincoln Electric Co., Cleveland, Ohio.
"Maintenance of Way Welding," by C. A. Daley, Engineer, Air Reduction Sales Co., New York, N. Y.

11:30 a.m. Exhibits and demonstrations.

Afternoon

1:00 p.m. Exhibits and demonstrations.

1:30 p.m. "Design and Welding of Pipe Systems," by F. C. Fants, vice-president, Midwest Piping and Supply Co., St. Louis, Mo.
"The Use of Welding by the Electric Light and Power Industry," R. W. Pursel, Indianapolis Power & Light Co., Indianapolis, Ind.
"Alternating Current Welding," by W. O. Westendarp, Jr., District Welding Specialist, General Electric Co., Schenectady, N. Y.

4:00 p.m. Exhibits and demonstrations.

Evening

7:00 p.m. Exhibits and demonstrations.

8:00 p.m. "Training Engineering Personnel in Welding," by Robt. E. Kinkead, consulting engineer, Cleveland, Ohio.
"Promoting Safety in Welding," by J. I. Banash, consulting engineer, Chicago.

Friday—December 14th

Forenoon

8:00 a.m. Exhibits and demonstrations.

9:00 a.m. "Application of Welding in Manufacturing Processes," by A. E. Gibson, vice-president, Wellman Engineering Co., Cleveland, Ohio.
"Application of Butt and Flash Welding in Industry," by P. W. Fassler, resistance-welding specialist, Detroit, Mich.

11:00 a.m. Exhibits and demonstrations.

Afternoon

1:00 p.m. Exhibits and demonstrations.

1:30 p.m. "Safety Suggestions for Handling Oxyacetylene Welding Equipment," by Albert Hardman, sales manager, Sight Feed Generator Co., Richmond, Ind.
"General Welding Practices," by A. O. Wanger, general manager, General Welding Products Co., Indianapolis, Ind.

3:30 p.m. Special demonstrations (to be announced).

A. W. S. to Hold Meeting in South Chicago

A program to appeal particularly to steel mills and refineries is being prepared for the November 30th meeting of the Chicago Section of the American Welding Society. The meeting will take place in the Y. M. C. A. gymnasium, 3039 East 91st St., convenient to the South Chicago industrial section. The program will start at 7:30 p. m., and will be preceded by a dinner in the Y. M. C. A. cafeteria at 6:15. Tom Jones, of the Illinois Steel Co., is in charge of arrangements.

A Plant Engineer Looks at Welding Salesmen

By R. J. COLLINS
Millers Falls Company

Practically all business has been "in the dumps" during the four years just past—welding included. And welding should not have been included—it should be a booming business. There is an unlimited field open to it. Industry cannot afford to be without it, not only on production work, but particularly for general maintenance and tool-room work.

The thing that is lacking is real intelligent salesmanship. The contact men should be selected from those who are familiar with the application of welding to general maintenance and tool-room work, for there is no other tool sold today that can compete with a welding outfit as a payer of dividends.

Seven years ago we bought a welding generator with only a hazy idea of just what we were going to use it for. We believed it would pay for itself eventually, but we didn't know how long it would take. When this purchase was decided upon, we contacted several well-known manufacturers. One of these sent us a salesman—he might have been a welder, though he seemed to have no idea of just what our needs were. Yet we bought a machine from him, but what sold us was the offer to have one of our men trained in a school conducted by the manufacturer.

As I look back, I don't exactly see how I had the nerve to ask my company to invest $1000 in a piece of equipment the use of which was so much "up in the air." But we bought it, and from the first it paid a dividend of at least double its cost every year. No industrialist can pass up a bet like that. Not if he knows it—but in some cases he doesn't know it, and for that he entirely isn't at fault.

When the prospect is contacted by a welding manufacturer, he is told about a bridge that is being welded in Massachusetts, a 22-story building being built in Texas, penstocks at Boulder Dam, or some other spectacular job that is very interesting to anyone doing welding but not even intelligible to someone who isn't.

If, instead, he were told that the welder could have repaired that worn or broken gage he had to replace yesterday at a cost of $25, and that the welder would have placed it back in service for only a few dollars; that it would have hard-surfaced the gage's wearing surfaces, and in a fraction of the time necessary to build a new one—would he have been interested?

Or, if he were told that the welder could have fabricated that fixture he ordered the pattern for yesterday, and would have had it ready for service, in production, before he could get the pattern made, much less the casting, and that the total cost would have been very little more than the base cost of the pattern—would he have been interested?

I'm sure he would, provided he were interested in reducing costs. Most of us are interested in economies; if we aren't we shouldn't be working for stockholders—and probably won't be for long.

Now that I have criticized the sales tactics of manufacturers of arc-welding equipment, I shall now speak my mind about salesmen of electrodes. One of these men, the other day, furnished me with three samples of rods and their trade serial numbers, along with the descriptive "flyer" supposedly describing the line. One of the rods was not listed. Furthermore, the "flyer" did not list the American Welding Society's specifications nor even the analysis of the manufacturer's rods. The salesman himself couldn't enlighten me regarding these matters, because he honestly admitted he knew nothing about electrodes or welding. The prospect probably would not "fall" for that type of salesmanship, and yet he might be passing up a good bet.

There is one manufacturer of hard-facing electrodes whom others could well afford to copy. He specializes in the oil-field and road-machinery line, and puts out a little magazine jammed full of information on how and when to use his materials—information complete to the smallest detail, including tricks that are acquired only by experience and lots of it. He also has an engineering staff of expert welders who know their business, and I consider it a real pleasure and privilege to meet them.

We are sold on welding, and know that our welder was the best investment we ever made. But we sold ourselves without outside assistance. The salesmen who called on us could not convince us that we should adopt welding, but we convinced ourselves that we should.

The sales engineer has something lacking. He should be able to weld and know welding well enough to be able to avoid technical phrasing—but how many do? He should understand the application of welding to industry and to the customer's individual needs, and be able to demonstrate his claims. That is not as difficult as it sounds. Any intelligent welder can easily spot an application of welding, and surely there must be enough welders with the necessary technical knowledge and experience in industry to qualify as sales engineers.

Much of the same thing applies to advertising, which should be both instructive and interesting. An "ad" that actually shows an example and explains procedure and costs would get to the executive who isn't must interested in sensational statements about "arc stability" and "overall efficiency."

These criticisms are made in the spirit of helpfulness, and they represent our experience with many supposed-to-be salesmen, and are also the experience of others with whom I have talked.

If a change in pioneering of welding were made along the lines discussed, everyone would benefit.

All-Welded Trailer for Transporting Livestock

An inexpensive trailer of all-welded construction for transporting live stock is shown in the accompanying illustration. It was built by one of the welding students in the Frank Wiggins Trade School, in Los Angeles, Calif.

Frames of old cars taken from the city dump or obtained at little cost from wrecking and salvaging yards, cut to the proper lengths and welded together, form the main frame of the trailer. The size

Trailer for Giving Old Dobbin a Ride.

of scrap is chosen according to the requirements of the different sections of the trailer frame.

Except for the lumber used in the sides and floor, and the labor required in assembling it, the cost of the trailer was practically nothing, and it was constructed in a little more than a day. It is about 10 ft. long and is wide enough to haul two horses.

The trailer has no springs, it being said by those experienced in the transportation of live stock that it is better that springs be omitted on trailers of this kind.

Matched lumber for the siding makes the trailer very neat and attractive in appearance. Lightness, strength, and low cost are valuable features, proving the superiority of arc-welded construction.

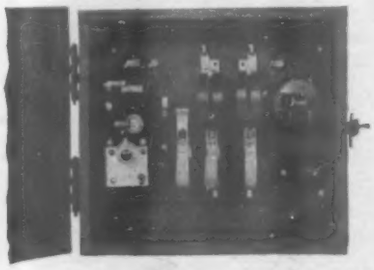
Strengthens Steel Framework With Reinforcing Plates

A contract for welding reinforcement plates on columns and beams on a new 10-story building at the Soldiers' State Hospital, near Ithaca, N. Y., was recently completed by the Blixt Welding Co., of Syracuse, N. Y.

New Equipment

Automatic Timer for Spot and Projection Welders

A new timer has been developed for automatically timing the power supply to resistance welders by controlling the contactor on the welder. It is operated by a synchronous motor having a speed of one revolution per second. This new timer was recently announced by the General Electric Co., Schenectady, N. Y., and is known as Type CR7993. This device eliminates human inaccuracy and guesswork, is easily and accurately set for the time most suitable for the work at hand, and, once set, it gives accurate time control unaffected by line-voltage



Motor-Operated Timer for Spot Welders.

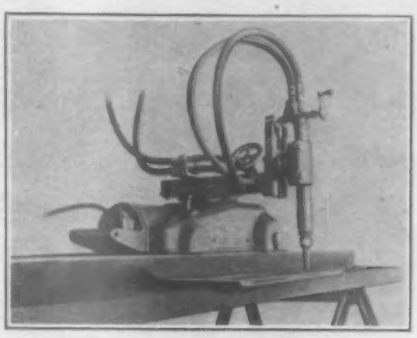
variations or surges. When adjusted for welding two thicknesses of metal, the control will provide satisfactory welds when several thicknesses of metal are placed between the electrodes, it is claimed, without any change in the timer or welder setting being required.

While the welder is idle, the timer motor tends to rotate in the reverse direction and holds a contact closed, making the initiating switch effective, so when the initiating switch is closed, the power contactor closes and applies power to the welder. The time motor then rotates in the forward direction and after a specified time, depending on the timer setting, operates another contact, which causes the welding contactor to open, regardless of whether the initiating switch at that instant is "on" or "off." Thus, the duration of current flow at the weld depends only on the setting of the timer and has no relation to the length of time the initiating switch is closed. The timer automatically resets itself for the next weld, but not until the previous weld is completed and the initiating switch is open.

The timer has a range of from 1/12th to 5/6th of a second in one-cycle steps (60-cycle supply). Longer welding periods, up to 5 seconds, can be obtained by the use of a lower-speed timer motor. The timer unit can be furnished with single- and double-pole contactors to handle the welding circuit.

Portable Cutting Machine With Handy Speed-Changer

A portable, self-propelled, hand-guided cutting machine with stream-lined design, known as the Oxweld Monitor CM-8 cutting machine, has been added



Hand-Guided Torch Cutting Machine.

to the line of oxyacetylene machines sold by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. This device does automatic straight-line cutting of practically unlimited length, straight bevel cutting (two bevels at a time if desired), plate-edge preparation, circle or ring cutting of diameters up to 100 in., and the cutting of curved or irregular shapes.

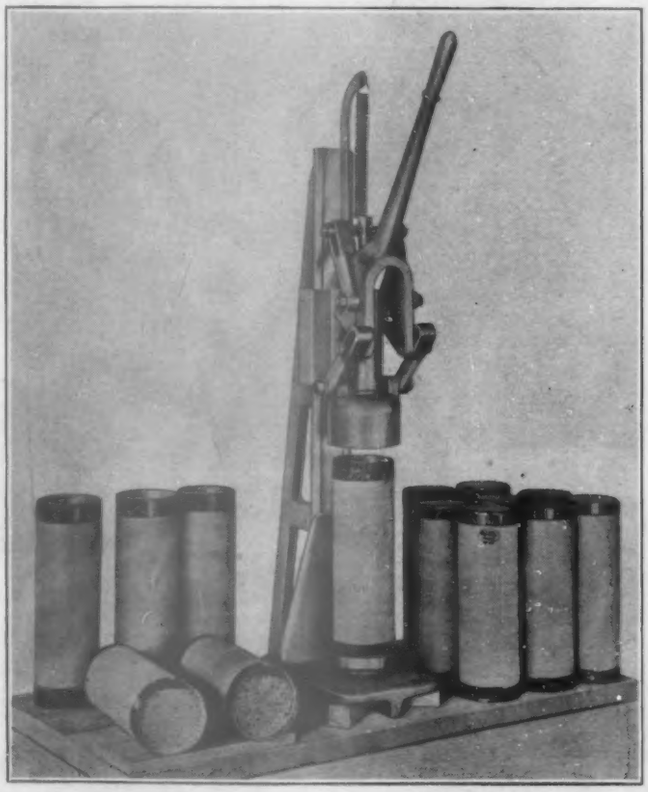
The Oxweld C-7 cutting blowpipe supplied with the device permits cuts up to 12 in. in depth, it is claimed, and a higher-capacity blowpipe can be supplied for heavier cutting and certain flame-machining operations. Also, two blowpipes can be used simultaneously, these being mounted either on the same or opposite sides of the machine and adjusted independently of each other.

By setting the speed indicator and shifting the gear lever, the operator can obtain any speed within the range of 2 to 48 in. per minute, and can alter the speed in an instant without stopping the work, merely by changing the speed regulator, which is conveniently located near the guiding handle.

The Monitor unit is complete, ready to plug into the power line without having to bother about extras. It is supplied with blowpipe and assorted nozzles, two 6-ft. lengths of track, and a radius attachment.

Sealed Plywood Containers for Shipping Welding Wire

Packing and freight costs on welding rods and electrodes can be reduced by the use of plywood containers of cylindrical form, known as "Tu-Ply" containers, according to claims made by the Seymour & Peck Co., 917 West 20th Place, Chicago, Ill., who have developed this type of container, together with a simple bench-type machine for sealing the tops. All containers have a reinforcing steel band at top and bottom. They will stand rough handling without damage, and they effectively keep moisture away from the product, it is claimed. Yet they are light in weight and are



Plywood Shipping Containers and Device for Sealing on the Tops.

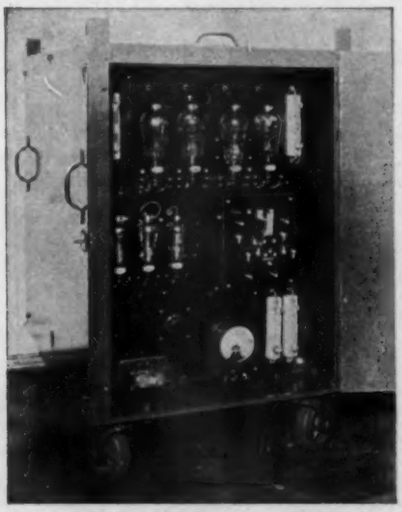
easily handled. They can be furnished in many different standard colors. The company say they will furnish samples, made to specifications.

"Ignitron" Timer for Cycle Welding

For the accurate timing of all types of resistence-welding machines, which is particularly important in the fabrication of aluminum, aluminum alloys and high-strength steels, a portable "Ignitron Welding Timer" has been developed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. This device, it is claimed, is so accurate as to pass electric current for periods as short as one cycle (1/60th second) and is adjustable up to 30 cycles (½ second).

The manufacture of the new light-weight streamlined trains, automobiles, airplanes and ships, with their metallic sheathing of strong, light-weight metals, has developed a demand for this type of welding timer.

The Ignitron timer is light in weight and very compact, making it readily portable. It is only 46 in. high, 42 in. long



Weld Timer Adjustable to 1/60 Second.

and 29 in. wide and it weighs approximately 700 lb. A unit of this size will handle as much as 700 kva. of electric energy at 440 volts, single phase.

New Flux for Silver Solders and Brazing Alloys

A patented flux, called "Handy Flux," has been announced by Handy & Harman, 82 Fulton St., New York, N. Y. This flux is said to speed up and improve brazing operations on stainless steel, carbon steel, monel metal, nickel, copper, brass, bronze, and other ferrous and non-ferrous metals and alloys, and is particularly appropriate for use with the silver solders and brazing alloys manufactured by Handy & Harman.

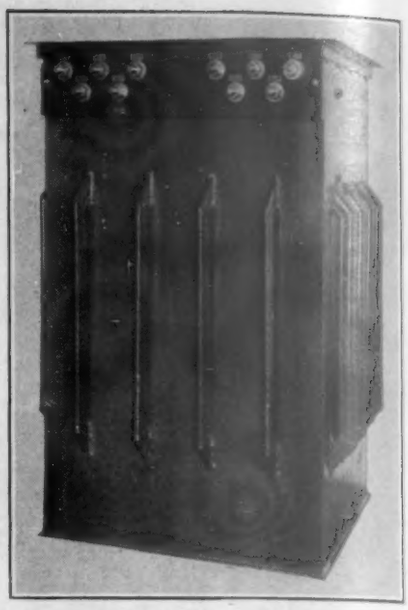
This new flux, with its low melting point, permits taking full advantage of silver solders and brazing alloys, such as Sil-Fos, having low flow points. Its high solvent action on a wide variety of oxides speeds up brazing and insures thorough wetting of the joint surfaces at low brazing temperatures, making it possible to obtain very strong and uniformly dependable joints.

It is said to work efficiently over a wide temperature range. In addition, it spreads rapidly over the work when heated and is not likely to ball up or bubble. Thus bare spots are avoided and the force of the torch flame does not blow away the flux with consequent oxidation. This promotes the even distribution of the solder. The flux slag washes off readily with a little hot water, it is claimed.

This flux is in paste form, ready for use, and is sold in ½, 1 and 5 lb. jars.

Large-Capacity, Oil-Cooled Alternating-Current Welder

A heavy-duty oil-cooled alternating-current welder has been developed by the Electric Arc Cutting & Welding Co., 152 Jelliff Ave., Newark, N. J. It has a



A. C. Welder Will Handle 1300 Amperes.

capacity of 1300 amperes and is adjustable for a load potential of 25 to 55 volts. This machine was developed for automatic welding. Radiating fins, welded to the tank, provide a means for circulating the oil and increasing the heat-radiating surface.

Trade Literature

Airco-Wilson arc-welding machines are described, and ratings and other engineering data given, in a pamphlet recently issued by the Air Reduction Sales Co., 60 East 42nd St., New York, N. Y. Arc stability, self-excitation, current control, commutation, and other important factors affecting the operation of the unit, are discussed. A preliminary statement points out that Air Reduction is the first manufacturer of welding equipment to serve both the gas and arc welding fields.

"Sheet Iron—A Primer" has just been published in its fifth edition by the Republic Steel Corp., Youngstown, Ohio. This 64-page booklet contains many illustrations of interest, and in simple, non-technical language it tells step-by-step the story of the manufacture of sheet iron, tracing production from the ore mine to the final inspection of the completed sheet. Gauge tables and a lucid glossary of metallurgical terms are included. Refer to Bulletin 127 when writing for a copy.

Prices of Norton abrasive products are given in a 130-page catalog recently issued by the Norton Co., Worcester, Mass. Among the products listed are grinding wheels of various types, abrasive segments, mounted wheels and mounted points, Alundum and Crystolon bricks and sticks, marble rubbing blocks, floor-surfacing blocks and wheels, and grinding-wheel dressers. Tables of weights and speeds of grinding wheels are included.

"Industrial Cable," a new 127-page publication of the General Electric Co., Schenectady, N. Y., describes and lists all standard types of insulated wire and cable used by industrials for arc welders, mining machinery, locomotives, neon signs, etc. This bulletin, designated as GEA-1838, is a companion to bulletin GEA-1837 on "How to Select Insulated Cable."

A list of the manufacturers for whom they are distributors, and an index of all commodities handled, are included in a folder recently issued by Williams and Co., Inc., 901 Pennsylvania Ave. N.S., Pittsburgh, Pa. Views of the company's Pittsburgh, Cleveland, and Cincinnati warehouses are shown. The folder is issued in commemoration of 27 years of service.

"We have always wanted to make a poor man's torch (like Ingersoll, a watch costing but little, yet keeping the time correctly). This we are proud to call our 'Craftmaster' torch," says Roy Thomas, inventor of this new torch, which

Only the *Genuine* has this Name Stamped on Every Rod!

THE trade-mark TOBIN BRONZE means uniformity in every rod... the same high quality in every package or case . . . day in and day out, year after year. This unvarying dependability IS worthwhile... IS something to ask for and get. Because with so many important factors in a welding job, why take a chance on the quality of your rod?

Time-tried Tobin Bronze carries its own name stamped every 12 inches in each rod. So, when you ask for "Tobin", look for this mark and make sure you are getting the genuine product.

Thousands of experienced welders will accept no other rod for the general oxy-acetylene welding of cast and malleable iron... locomotive cylinders, automobile engine blocks, cast iron pipes, machinery parts and similar equipment.

MELTING POINTS OF ANACONDA WELDING RODS		
Material	Approximate Melting Point—Degrees	
	Cent.	Fahr.
Tobin Bronze* . .	885	1625
Manganese Bronze	870	1598
Brazing Metal . .	930	1706
Naval Bronze . .	885	1625
Everdur*	1019	1866
Phosphor Bronze A	1060	1922
Phosphor Bronze E	1070	1958
Phosphor Bronze D	1000	1830
Phosphor Bronze C	1025	1877
Silicon Copper . .	1083	1981
Deoxidized Copper	1083	1981
Electrolytic Copper	1083	1981
Nickel Silver . . .	1055	1931
Ambrac*	1150	2102

*Trade-marks Reg. U. S. Pat. Off.

ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Connecticut

Offices and Agencies in Principal Cities

In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

NRA CODE

ANACONDA WELDING RODS

is described in a folder. Copies may be obtained by writing the Torch Supply Shop, 1637 E. Vernon Ave., Los Angeles, Calif.

Two new pamphlets on welder specifications have been issued by The Lincoln Electric Co., Cleveland, Ohio. One of these covers the engine-driven Type SA400 "Shield Arc" welder, and the other gives general specifications for SA300, SA400 and SA500 "Shield Arc" welders with d.c. motor drive.

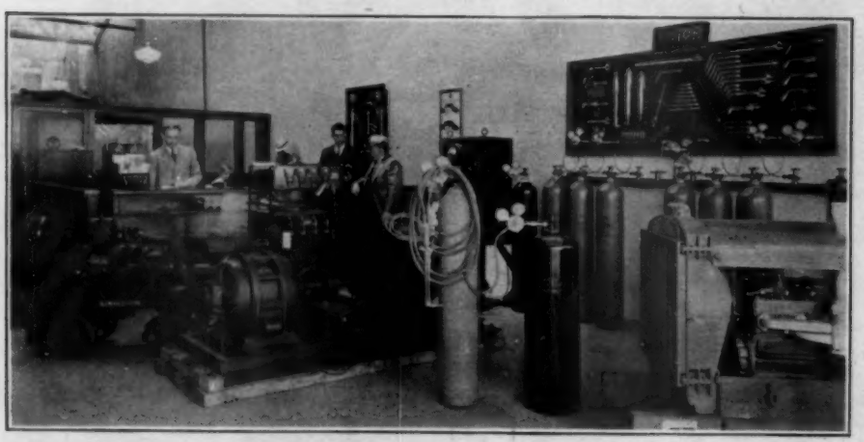
"Titan" doubly deoxidized bronze welding alloys are listed and welding procedure described in a folder issued by the Titan Metal Manufacturing Co., Bellefonte, Pa. Particular emphasis is given the low melting point of the "Penn Freeflo Bronze."

"Milburn" cutting and welding torches and accessories are listed and described in a pocket-size 34-page catalog recently published by The Alexander Milburn Co., 1403 W. Baltimore St., Baltimore, Md.

Commercial News

"Victor" Holds Celebration in New Quarters

To celebrate their recent removal into new and larger quarters, the Victor Welding Equipment Co., of Los Angeles, Calif., gave a "housewarming" party for their friends and business associates on the evening of Sept. 8th, in their new location at 2037 S. Santa Fe Ave. In addition to the "Victor" line of gas welding and cutting equipment, this company also handles the General Electric line of arc-welding equipment and supplies.



Office and Part of Display Room in Victor Welding Equipment Co.'s New Quarters.

Steel & Tubes, Inc., of Cleveland, Ohio, announces that Charles H. Reinert, formerly superintendent of the company's Brooklyn plant, is now assistant superintendent of the electric weld tube mill of the parent corporation, Republic Steel Corp., at Youngstown, Ohio; also that M. B. Steele, formerly of the Cleveland office, has been transferred to Boston as assistant to E. T. Glass, sales manager of the New England Division.

J. R. Ridlon, consulting engineer with the Tech Manufacturing Co., of New York City, was a visitor at the National Metal Exposition in New York last month. In stature he favors his brother "H.O.T.", of the Bastian-Blessing sales force. Another one of the Ridlon family recently broke into print when the boys' sister, Jeannette, who is the wife of Jean Piccard, distinguished herself as the first woman to make a stratosphere ascension and also the first of her sex to obtain a balloon pilot's license.

Jake Underwood, of the Electric Cutting & Welding Co., 7506 Atlantic Blvd., Bell, Calif., who deals in welding supplies and rents arc welders, recently completed the construction of a "house on wheels," in which, with his family, he plans soon to take a trip to northern California, Oregon and Washington, in the course of which he will feature welding supplies and equipment, and also introduce his new magnetic governor for motors.

A Milwaukee, Wis., branch office has been opened by the Machinery & Welder Corp., of Chicago, Ill. Complete welding stocks and service will be maintained and offered in the new office, which is located at 2118 W. National Ave. Roy C. Kendall is in charge.

The many friends of R. C. Anderson in the Boston district territory will be interested to know that he is now connected with the Engineering Sales Corp., recently appointed General Electric arc-welding distributors in the Boston territory, with offices at 140 Federal St. Some time ago Mr. Anderson served New England for 10 years as General Electric arc-welding specialist.

The American Brass Co. will have on exhibition Anaconda condenser tubes in standard and special alloys, deoxidized copper tubes and fittings, Everdur storage tanks, and Beryllium Copper, at their booth, No. 65, at the Power Show to be held in the Grand Central Palace, New York City, Dec. 3rd to 8th.

The Champion Rivet Co., of Cleveland, Ohio, announce the appointment of the Chicago Steel-Service Co., 3912 S. Ashland Ave., Chicago, Ill., as exclusive distributors of their welding rods in the Chicago territory. A complete line of all "Champion" electrodes will be stocked.

The Welding Engineering Sales Corp., with offices in New York City, Boston, Syracuse, and Newark, opened an office in Buffalo, at 1 W. Genesee St., on Nov. 15th. This firm was recently appointed exclusive distributor for General Electric welding equipment and accessories.

Wooldridge Aluminum Welding Products, of Glastonbury, Conn., recently completed an enlargement of their production facilities, made necessary by an increased demand for their aluminum welding supplies.

A Dallas, Texas, office has been opened by Revere Copper and Brass, Incorporated, in 804 Tower Petroleum Bldg., 1905 Elm St., in charge of W. Russell Weil, southwestern district manager.

G. C. Hunt & Co., welding engineers, have opened a branch office at Jacksonville, Fla. Manganal welding rods, made by the Stulz-Sickles Co., will be handled.

The Wayne Welding & Supply Co., Fort Wayne, Ind., has been appointed distributor for "Ever-Kler" cover lens, by F. R. Faulk, Pittsburgh, Pa.

Sydney Hollister, 42 S. Second St., Newark, Ohio, has been appointed distributor of the fluxes manufactured by Pratt-Brayman, of Oscoda, Mich.

Robert J. Working has been appointed district sales manager in Cincinnati for the Republic Steel Corp., succeeding W. A. Peck.

The Chicago office of C. E. Phillips & Co. has been removed to 324 S. Jefferson St. J. C. ("Jack") Menzies is in charge.

Notes From the Field

Repairs Farm Drags, Then Sells Them

A profitable sideline in the repairing and sale of farm drags has been built up by Vanderpels & Madderom, of Zeeland, Mich., who operate a blacksmith and welding shop and also do automobile repairing.

They scurry around the country and buy up, for a very small sum, old drags that have been bent, broken or badly worn. They weld the frames, if they are broken, and straighten them, and also weld all loose rivets, so the repaired frame is very solid. The bearings and shaft, which form the adjustable part of the drag, are built up with Bingrod with a medium hardness. The drag shoes, which are almost always worn out, are replaced with new ones made from old automobile bumpers, which can be picked up for almost nothing. The drag points are reshaped and dressed and, when the idea can be sold to the buyer, these points are hard-faced with Bingrod applied very hard.

The completed drag, after being painted, has as good an appearance as a new one and has a longer life, and the cost is but a fraction of the price of a new one.

Over a hundred of these repaired drags have been sold, usually in two or three sections, or, if used as tractor drags, in three or four sections. In the latter case, means are provided so the dragging depth can be controlled from the tractor seat.

Roy Thomas, of the Torch Supply Shop, 1637 E. Vernon Ave., Los Angeles, recently purchased a patent from the inventor, Ray W. Tadd, covering a welding-hose connection, which, when unscrewed from the torch, automatically closes. This new device will go on the market as soon as new machinery is installed for production.

The O K Welding Shop, of San Bernardino, Calif., under the management of Paul Yacoby, has a newly completed portable electric welding unit. The machine, which is entirely homemade, consists of a Buick touring car into which is installed a 150-ampere Wilson generator driven by a power take-off from the car motor. The generator is controlled by an electric governor, and has a double chain drive with but 11 in. between the drive shaft of the generator and the transmission gears. This feature, with Timken bearings installed throughout, affords unusual smoothness of operation. Short sections of heavy pipe welded into the frame of the car beside the electric unit also afford facilities for hauling an oxyacetylene outfit.

William T. Casey, president of the Commercial Iron Works, of Portland, Ore., died on Oct. 23rd from injuries received in an automobile accident. He was 53 years of age. Mr. Casey was well known in the Pacific Northwest welding field, having many large and also intricate jobs to his credit. His latest, finished just a few weeks before his death, was the Santa Cruz cement plant, an outstanding accomplishment.

C. H. Jensen, welding and blacksmith shop owner, formerly operating on South San Gabriel Blvd., in Pasadena, Calif., has moved to El Monte and opened a shop at 132 Hoyt Ave. Mr. Jensen is well known in El Monte, having for a number of years operated a shop there prior to going to Pasadena. He specializes in the manufacture and repair of agricultural tools.

To take care of an increase in business, the Nourse-Watson Machine Works, of Seminole, Okla., have taken on additional help and are now employing six welders and two cutters, whereas at the first of the year they were employing only one welder. The firm recently bought a new 300-ampere Lincoln arc welder powered by a V-8 motor.

A contract for installing 3-in. and 6-in. pipelines, with welded joints, for handling Texaco oil and gasoline from tank cars to service stations, was recently completed in the cities of Rome and Geneva, New York, for the Z & M Oil Co., of Norwich, Conn. The welding was done by the Blixt Welding Co., of Syracuse, N. Y.

E. L. White, proprietor of the Elco Welding Works, 3438 E. Slauson Ave., Maywood, Calif., is opening a branch shop in Los Angeles at Seventh St. and Alameda Blvd. The new shop will be in charge of Walter Fietze, who has for some time been associated with Mr. White in the Maywood shop.

Jack Cooper, proprietor of the C & L Garage, 2729 W. Valley Blvd., Alhambra, Calif., recently added an electric welding unit to his shop equipment. The unit, which was built by Mr. Cooper himself, is of the motor-driven trailer type, with a 300-ampere General Electric generator.

A total of 40 students have enrolled in the day classes of the welding department of Frank Wiggins Trade School, at 16th St. and Olive, in Los Angeles, Calif. Two classes are conducted—one in the forenoon and one in the afternoon. Gas and arc welding are taught.

The Superior Machine Shop, 1352 State St., San Diego, Calif., recently added electric welding to the services of their shop. A new 300-ampere electric-motor driven General Electric unit has been installed. A. Nordstrom is owner and manager.

H. L. Mills, formerly associated with M. Marco as a partner in the Pacific Welding Co., 1669 S. Alameda Blvd., in Los Angeles, has taken over the interest of Mr. Marco and will operate the shop under the name of the Mills Welding Service.

A bridge being built by the Northern Bridge Co., 10 S. LaSalle St., Chicago, Ill., at Logansport, Ind., for the Indiana State Highway Commission and the Wabash Railroad, has the trough floor construction completely welded to the bridge girders.

A contract for several small gathering pipelines to be installed in the Fish Pool territory has been awarded the Nourse-Watson Machine Works, Seminole, Okla., by the Empire Oil Co. Welding will be used.

The Atlas Scraper & Engineering Co., of Bell, Calif., manufacturers of all-welded equipment for highway construction and mining, are erecting a new traveling crane in their plant on Maywood Ave.

The Hill Motor & Welding Service, of 1125 First Ave., San Diego, Calif., recently added electric welding to their general motor repair work. A 300-ampere Shrader electric welder is being used.

Mr. Nourse has withdrawn from the Nourse-Watson Machine Works, of Seminole, Okla., and it is understood that he is now associated with the Okmulgee Gas Engine Works, of Seminole.

The American Iron & Machine Works, Inc., manufacturers of oil-well equipment, are now working full force, with two shifts per day, in their plant in Oklahoma City, Okla.

Joe Lynch recently opened a boiler and welding shop in the new Ada, Okla., oil field. Mr. Lynch formerly had shops in the east Texas and Oklahoma oil fields.

The Kansas State Highway Commission are soon to ask for bids on an all-welded 400-ton bridge, it is reported.

· CLASSIFIED ADS ·

Help Wanted—75c per line, minimum 4 lines. Jobs Wanted—4 lines free. Other Ads—$1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

PERSONAL

$25.00 Reward—This amount will be paid for information giving the location of an arc-welding machine which B. Robinson, lately of the Welding Engineering Co., 1800 L St. N. W. (rear), Washington, D. C., obtained from us, and which was removed from the above premises without our consent. Electric Arc Cutting & Welding Co., Newark, N. J.

FOR SALE

For Sale—200 and 300 ampere electric-drive and gasoline-engine-drive arc welders in stock, also transformer-type welders up to 600 amperes. Goodman Electric Machinery Co., 1060 Broad St., Newark, N. J.

Bargain—One five-operator G-E 800-amp. Welder, a.c. motor drive. A-1 condition. Also all makes and sizes of used arc welders for sale or rent. Guaranteed. Service Co., 3741 Cedar Ave., Cleveland, Ohio.

Bargains—Demonstrator Arc Welders. Gasoline, electric drive, belted, or coupled-together outfits. 30 days' trial. Easy terms, if desired. Write Ken's Welding Exchange, Box U-1141, Troy, Ohio.

For Sale—Lincoln 200-Ampere Portable Welder, rebuilt completely. For operation on 110 volts d.c. power. Price only $200.00. Welding Engineering Co., Milwaukee, Wis.

BUSINESS FOR SALE

Brazing and Welding Compound Business For Sale—Product known from coast to coast. Established many years. Will bear rigid investigation. Address N-6, The Welding Engineer.

AGENTS AND DISTRIBUTORS WANTED

Territories open for agents or distributors to merchandise on exclusive basis an arc-welding process consisting of an outstanding machine, superior electrodes and accessories, plus welding engineering service of highest caliber. High earning possibilities for aggressive representation. State experience and give references. Address N-2, The Welding Engineer.

POSITIONS OPEN

Wanted—Sales engineer to merchandise outstanding Arc Welder and Electrodes. Must know metals, fundamentals of structural design and shop practice, with some knowledge of electricity. Some sales experience preferred. Salary and liberal bonus to producer. Unlimited earnings depending upon results produced. Give full information with application, which will be kept absolutely confidential. Address N-1, The Welding Engineer.

Wanted—Shop Superintendent with thorough knowledge of welded truck-tank manufacture, to take full charge of production work. Capable of laying out the work and checking costs. Address N-3, The Welding Engineer.

POSITIONS WANTED

Welding Technologist—University education; 17 years' welding experience in various capacities, including shop and field welding, shielded arc welding, and welding of non-ferrous metals. Can sell and demonstrate equipment, also instruct, or can handle a crew of men or run a shop. Experienced in all types of work where welding is used for fabrication. Will go anywhere. Address N-4, The Welding Engineer.

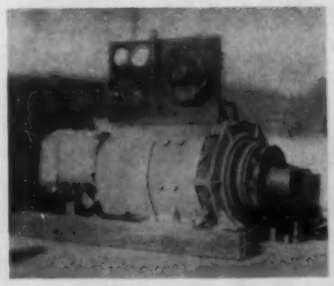
Welding Supervisor—Experienced in structural-steel fabrication, tanks, steam and refrigeration pipe welding. Eighteen years' machine and job shop work, gas and arc. Now overseer of welding on large construction job. Available about Dec. 1st. Address N-5, The Welding Engineer.

Arc Welder and Chauffeur—15 years' practical experience in shop and ship repair; 2 years as welding-shop proprietor. Married; 38 years old. Reference or bond. H. Smuckler, 357 McDonald Ave., Brooklyn, N. Y.

Combination Welder and Foreman—11 years' experience in arc and gas welding on all kinds of metals, five years as foreman. Will go anywhere for steady position. C. L. Berry, 41 N. St. Clair St., Dayton, Ohio.

Oxyacetylene Welder—13 years' experience, mostly on railroad cars. Have also handled the arc. Frank Francisco, 59½ N. Jackson St., Frankfort, Ind.

Now!—
"SURE-ARC" WELDERS



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